CONTENTS

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SRI METHOD - A WATER SAVING TECHNOLOGY IN RICE - PRESENT STATUS AND FUTURE PROSPECTS

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ABSTRACT

The water demand in the year 2000 was 634 km^3 and it is likely to be 1,093 km^3 by the year 2025. Due to rapid rise in population and growing economy of the country, there will be continuous increase in demand for water, and it will become scarce in the coming decades. While India is considered rich in terms of annual rainfall and total water resources, its uneven geographical distribution causes severe regional and temporal shortages. However, there exist considerable spatial area temporal variation in the distribution of rainfall and hence unavailability of water. There are technologies for reducing water requirement of rice in India. Among them, System of Rice Intensification (SRI)[1], an alternate rice cultivation methodology developed in Madagascar 25 years ago is gaining wider acceptance in many countries including India. SRI method claims to greatly enhance water productivity and grain yield but there is lack of understanding of scientific principles underlying and synergetic effects of the principles followed in SRI method especially in Indian conditions. Hence, in the present paper, significance and necessity of SRI and summarises the results of the evaluation of SRI method across the country at 25 locations for four years and the results obtained regarding various practices of SRI at Directorate of Rice Research(DRR). The results clearly indicated 7-20 per cent higher grain yield over the traditional irrigated transplanted rice across the country in different soil and climatic situations. SRI method resulted in higher nutrient use efficiency without depleting the soil available nutrients as compared to conventional transplanting after two seasons of the study. The varieties having better tillering ability and hybrids (KRH-2, HRI126, PHB-71 and DRRH-2 across the locations and BPT 5204 at Rajendranagar) were found promising and recorded higher grain yield over HYVs and scented cultivars having with moderate tillering. SRI method reduced the seed rate by 80% and nursery area, water requirement by 29% and growth duration by 8 – 12 days; thereby enhancing the water productivity and per day productivity of rice cultivars. SRI also helps to produce more seed and faster seed multiplication and also quality seed for higher productivity. The water saving alone should be a strong justification for adopting SRI method wherever water is not abundant. There is a need for further enhancing the productivity of rice under the SRI method by identifying the suitable cultivars, modification of practices to suit local agro-climatic conditions which plays an important role in mitigating the effects of climatic change.

Key words: System of Rice Intensification, Water and Rice productivity

Food security in India is closely linked to sustainable rice production as it contributes > 42 % of the total food grain production and is the staple food for more than two thirds of population. Irrigated rice (58% of the total rice area of 44 m . ha) is the most productive system accounting for more than 76% total rice production. Hence, while sustaining increased productivity of irrigated rice is vital to meet the future demand of 130 million tons of rice by 2025, there is an immediate need to reduce and optimise irrigation water use in the light of declining water availability for agriculture in general and to rice in particular. Since irrigated rice production is the leading consumer of water in the agricultural sector and countries most widely consumed staple crop, finding ways to reduce the need for water to grow irrigated rice should benefit both producers and consumers contributing to water security and food security.

However, adequate water availability for rice production is becoming a major problem owing to depleting groundwater levels, water quality degradation, rising demands from other sectors. Also, rainfall reduction and variability are creating problems for farmers even if only a cyclical rather than a permanent constraint. Rainfall patterns in many areas are becoming more unreliable, with extremes of drought and flooding occurring at unexpected times. Further, it is estimated that, by 2025, 2 million ha of Asia's irrigated dry-season rice and 13 million ha of its irrigated wet-season rice may experience "physical water scarcity", and most of the approximately 22 million ha of irrigated dry-season rice in South and Southeast Asia may suffer "economic water scarcity" (Tuong and Bouman,2003). There is a wide variation in the water requirement of rice ranging from 800 mm to 3000 mm ha^{-1} (De Dutta, 1981) during the crop season. This translates to 220

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to 820 Km^3 of water utilized for irrigation at the current level of rice production, a share of water which is unlikely to be sustainable with the increasing competation from domestic and industrial sectors and ecosystem needs. With significant economic diversification and uncertainity in the impacts of climate change on water balance, the share of water to rice is likely to decrease in absolute terms. This warrants increasing rice production with less and less use of water i.e *"more crop per drop of water"*.

Globally rice is cultivated on 164 million hectares (m ha) with an annual production of around 722.8 million tons (m t) of paddy at an average productivity of 4.43 t/ha during 2011 (FAOSTAT, 2014). Though India has the largest rice acreage with 44 m ha (26.87% of global area) it stands second after China with respect to production (155.7 m t i.e. 21.5% of global production) owing to its low productivity. Currently India produces rice that is sufficient not only to meet the domestic demands but also of exports (largest exporter during 2012). However, the rapidly increasing population projected to be 1.6 billion by 2050 calls for stepping up the current production of 103.5 m t of milled rice to 140 m t by 2050 at enhanced productivity of 3.5 t/ha. Major rice production in the country comes from the states of West Bengal, Andhra Pradesh, Uttar Pradesh and Punjab. Future increases in rice production has to come from lesser and lesser resources (land, water, labour etc.) with due consideration given to keep the environment safe and continuously enhance profitability in rice cultivation.

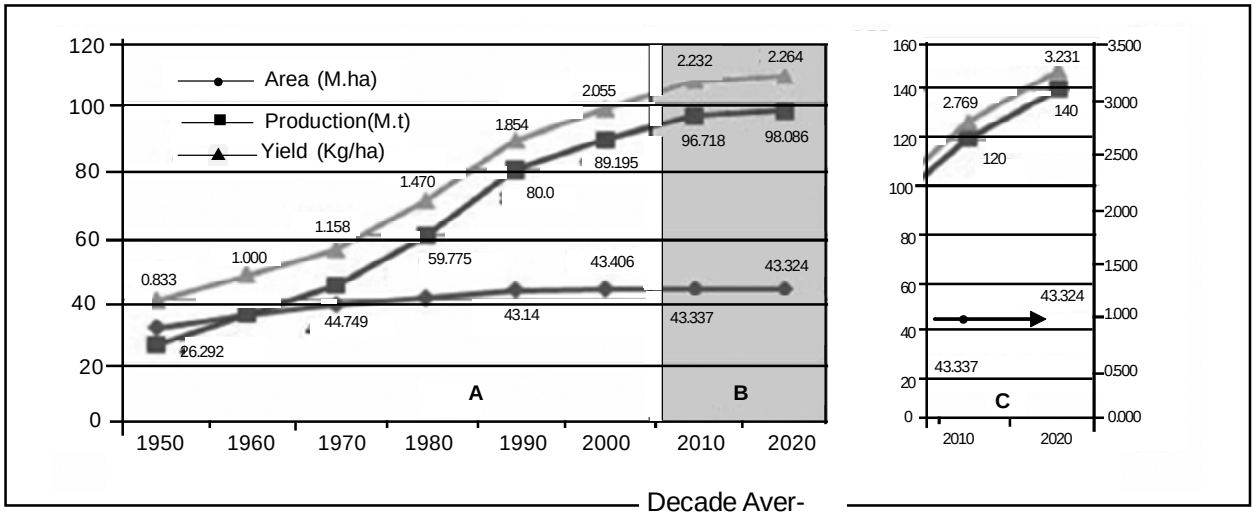
Existing irrigated rice cultivation practices are water-intensive and entail large amounts of non-productive water losses in the form of seepage, deep percolation and evaporation. Rice has long been believed that to be an aquatic plant, or at least a hydrophilic one. Evidence shows this view to be incorrect and the International Water Management Institute (IWMI) has published a monograph bringing together evidence on this relationship (Guerra *et al.* 1998).

Hydrologists typically assess scarcity by looking at the population-water equation. An area is experiencing water stress when annual water supplies drop below 1,700 m^3 per person. When annual water supplies drop below 1,000 m^3 per person, the population faces water scarcity, and below 500 cubic metres "absolute scarcity" (FAO, 2014). According to International norms, a country can be categorized as "water stressed" when water availability is less than 1700 m^3 per capita per year. However, it is projected that per capita surface water availability against 5200 m^3 in 1951 and 1588 m^3 in 2010 is likely to be reduced by 1401 and 1,191 m^3 by the years 2025 and 2050, respectively. (United Nations World Water Development , 2012). There is a need to better understand the vulnerability and develop resilience and adaptability of different water management innovations, structures and technologies/ measures in stimulating and dealing with the changing environment. The measure for tackling climate change impact include water resources development and integrated water resources management such as increasing availability of usable water, improving the efficiencies for water use, ground water measures and agronomical measures. Some of the on farm technical interventions that have promise and potential to enhance water productivity in rice include, alternate wetting and drying (AWD), evapo-transpiration (ETc) based water scheduling , furrow irrigated raised bed method (FIRB), aerobic rice, direct seeding and of late system of rice intensification (SRI).

Thus to achieve long-term food security and sustainable development in India, water saving in rice production through development of water use efficient cultivars, suitable water saving technologies and integrated crop management practices are critical and very important.

Rice production scenario in India

In India, rice is not only a food commodity but also a source of foreign exchange earning about 11,000 cores annually, India has witnessed a remarkable progress in rice production. There has been one and half times increase since attaining independence in 1947 in the area from 30 to 44 m.ha. The productivity increased three times from 700 kg ha^{-1} to 2480 kg ha^{-1} and the total annual rice production of the country has increased more than four times from 22 m.tons to 104.8 m.tons (2014-15). Based on the current rate of population growth (1.4%) and per capita consumption (215 - 230 g/day), the projected demand for rice by 2025 would be around 130 m tones. The rice production has to be invariably enhanced additionally by more than 2 m. t. annually to meet the future requirements (Fig.1).



(Kumar *et al.* 2013)

Fig 1. Rice Area, Production and Productivity 1950s up to 2020

India needs to produce two million tons of additional rice every year for the next 20 years

The projected demand has to be met in the background of declining land and water resource scarcity of labour and costly inputs which are making rice cultivation too expensive. Reducing the cost of cultivation and making rice cultivation more profitable to the farmers is the need of the hour. Among these constraints water scarcity will pose a major threat to rice cultivation and all our efforts are needed to enhance water productivity and to ensure production of more rice crop from every drop of water.

Water and irrigated Rice

Irrigated rice occupies 50% area and contributes nearly 70% to total rice production of the country with an average yield of 3.1 t/ha. India's food security largely depends on irrigated rice which consumes nearly 50- 60% of our finite fresh water resources. Flooded rice requires 900-2250 mm of water (average 1500 mm) depending on the water management, soil and climatic factors (Table.1). It is estimated that rice needs about 3000-5000 liters of water to produce one kg of grain which is three to five times more than for other cereals like wheat, corn etc. The expenditure towards water alone is 20-30% of the total variable cost of rice production.

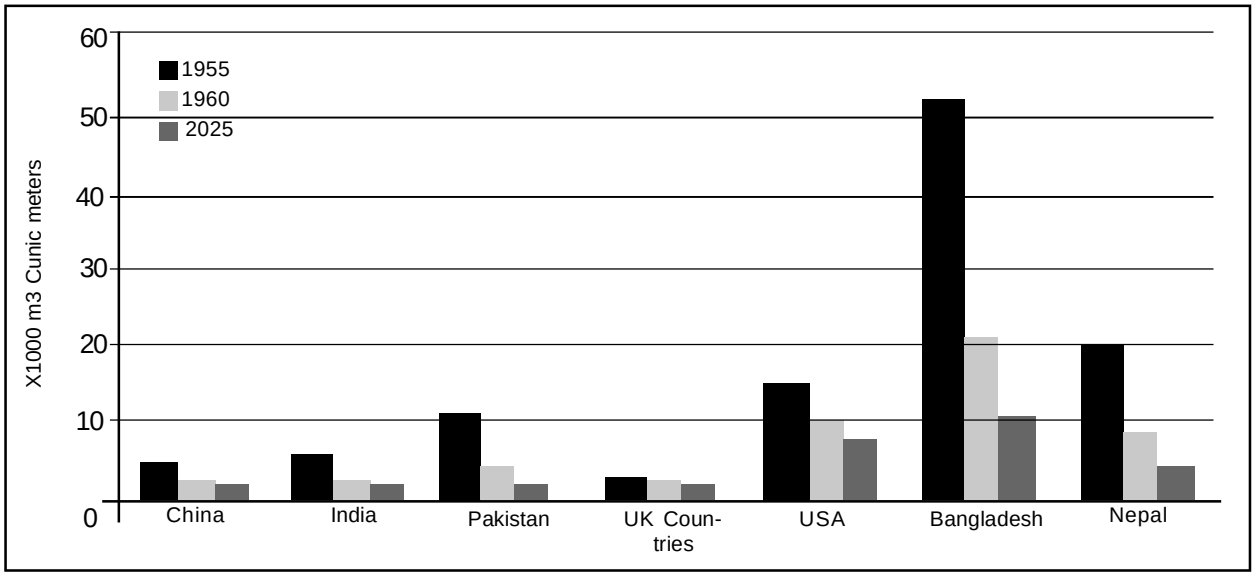
Table 1. Average water requirement of irrigated Rice

Farm operation/process	Consumptiveuse of water (mm)
Land preparation	150 – 200
Evapo-transpiration	500 – 1200
Seepage and percolation	200 – 700
Mid season drainage	50 – 100
Total	**900 - 2250**

(Bouman and Tuong, 2001)

There is growing awareness about the need to optimize water use in rice production which will have far reaching effects. At constant level of fresh water availability, per capita supply of water is decreasing progressively with time. Besides, competing demands for water from industrial and urban sectors, and the predicted climate changes are likely to further accentuate the impending water crisis more so for rice production which warrant change in the practices adopted for rice cultivation. Water is going to be most

critical input in the future for agriculture in general and rice cultivation in particular. Per capita water availability has dwindled from 5.3 x$10^3$$m^3$/year in 1955 to 2.5 x$10^3$$m^3$/year in 1990 and is expected to further shrink to 1.5 x$10^3$$m^3$/year by 2025 (Fig.2). Share of water for agriculture is likely to drastically go down from 90% to less than 60%. Rice cultivation has traditionally been in water impounded paddies and hence rice has come to be known as water loving crop. The ability of rice to survive and grow under water submerged soil and effective weed management through standing water have further given credence to this view. Hence water productivity in rice cultivation has been the lowest. Fortunately, this aspect of rice cultivation is undergoing radical changes and technologies are being aggressively developed for more water productive cultivation practices such as System of Rice Intensification (SRI), direct seeding, aerobic rice and alternate wetting and drying are some of these practices. Reducing crop duration without affecting productivity is another approach.



(Kumar *et al.* 2003)

Fig 2. Per capita water availability in selected countries (000m^3)

System of Rice Intensification

The System of Rice Intensification, known by its acronym 'SRI', is gaining popularity among paddy farmers in several states. This method has the potential to improve productivity of land, capital, water and labour simultaneously. SRI is a system of growing rice which involves principles that are at times radically different from the traditional ways of growing rice. It involves planting of single and young seedlings with care instead of conventional method of multiple and mature seedlings from the nursery. SRI spaces rice plants more widely and does not depend on continuous flooding of rice fields. It uses lesser seed, chemical inputs and promotes soil biotic activities in and around the root zone, due to liberal applications of compost and weeding with a rotating hoe that aerates the soil. These changed practices with lower inputs lead to enhanced yields with considerable savings of inputs especially the water which is becoming scarce over the years.

System of Rice Intensification – A water saving and productivity enhancing technology

The future of country's rice production will depend heavily on developing and adopting strategies and practices that use irrigation water efficiently at the farm level. SRI is one such method which has a potential to produce more rice with less water. Until 1990, the impression was that rice yields better only under flooded conditions. Recent reports from International Water Management Institute, Colombo, however suggest that continuous submergence is not essential for obtaining higher rice yields and experience with the System of Rice Intensification (SRI) techniques also shows that farmers who grow irrigated rice with continuous flooding have been wasting large volumes of water (Uphoff, 2006). Further, experiences from

studies on SRI in China and Sri Lanka during the last decade have conclusively demonstrated that unflooded soil is ideal for rice plant to grow well and yield better than under conventional method of continuous shallow submergence.

According to Dr. Norman Uphoff Professor Cornell University, USA (2005) and leading campaigner of SRI, this revolutionary innovative technology was borne out of personal experience of Fr Henry de Laulanie at Madagascar (Laulanie,1993), and not as a development of scientific research (Shambu , 2006). SRI method has spread to nearly 54 countries and with many success stories and now efforts are on to generate and establish the scientific mechanisms responsible for the observed crop responses under SRI. In view of several advantages with this method, it has caught attention of major rice growing countries and is presently being tried as an innovative practice in several Indian states viz., Bihar, Tamilnadu, Tripura, Orissa, Punjab Chattishgarh and including Andhra Pradesh. The Bihar poverty-reduction programme cited in the proceeding section on pulse system of crop intensification (SCI) reported that (2012) over 60000 households were using SCI methods to improve their growing of tomatoes, eggplants, and other vegetable crops on 5244 ha. Their average increase in yield was 20%, but their net income/hectare was 47% greater given their lower costs of production (Behera et al., 2013). The area under SRI is reaching to an extent of one m ha with bulk of the area covered in Bihar state during last two years. Spread and Adoption of SRI More than 10 million farmers benefit from SRI methods in 54 countries (2013) www.sririce.org eds8@cornell.edu SRI-Rice (2014).

SRI which is relatively a new methodology involves a set of practices for plant, soil, water and nutrient management. It is a revolutionary technology in the sense that it tries to change traditional practices especially with respect to water management that existed for thousands of years.

Principles of SRI

SRI Principles that underlie SRI practices are more important than the practices themselves.

- Rice is not an aquatic plant. Although rice can survive when grown under flooded (hypoxic) conditions, it does not really thrive in such a soil environment. Under continuous submergence, most of the rice plant's roots remain in the top 6 cm of soil, and most have degenerated by the start of the plant's reproductive phase.
- Rice seedlings lose much of their growth potential when transplanted beyond about 15 days of age. This potential is preserved by early transplanting in conjunction with other SRI practices.
- It is important to avoid trauma to seedlings, and especially to their roots, during transplanting. Stresses such as from seedlings' roots drying out will delay the resumption of plant growth after transplanting and reduce total tillering and root development (transplanting shock).
- Wider spacing of plants leads to greater root growth and accompanying tillering, provided that other favorable conditions for growth such as soil aeration are provided. With intact root systems, there is a positive correlation between tillering and grain filling.
- Soil aeration and organic matter create beneficial conditions for plant root growth and for consequent plant vigor and health. This results from having greater abundance and diversity of microbial life in the soil, helping plants resists pest and disease damage.

Based on the above principles, basic six practices includes:

The greatest potential of SRI is seen when the six important practices are adopted together (fig.3)

1. Transplanting young (8-12 day old) seedlings
2. Careful transplanting of single seedling at shallow depth
3. Adoption of wider spacing (25 cm x 25 cm)
4. Water management to keep soil moist by alternate wetting and drying.
5. Inter-row weeding using rotary weeder and
6. Use organics such as FYM/Compost.

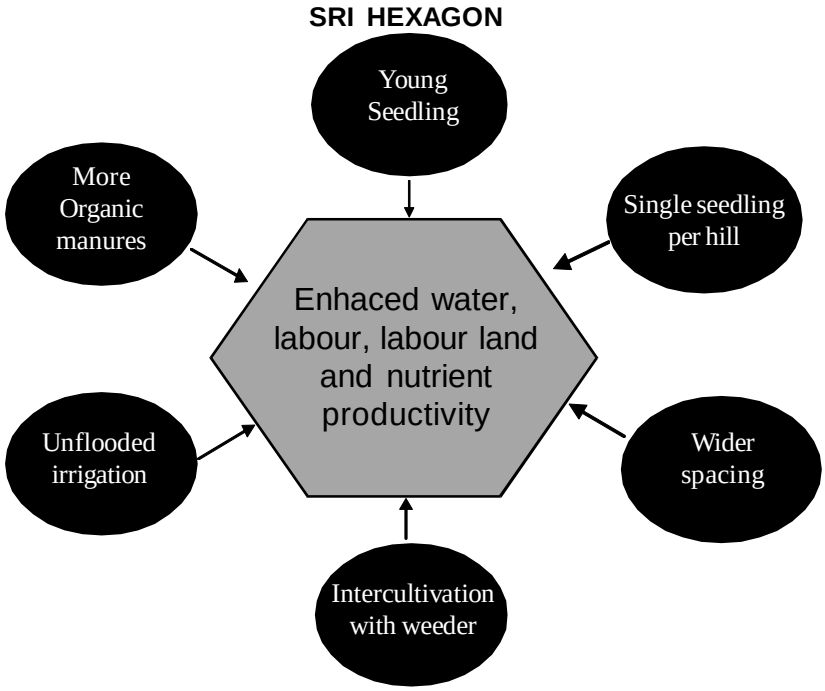


Fig.3 Practices of SRI for enhancing the resource productivity

Following are some desirable and best practices of SRI for harnessing the higher productivity (Table-2)

Table 2. Best practices for SRI

S.No	Principles	Rationale for the Principle	Best Practices	Desirable
1	Utilise young seedlings and single seedling	More prolonged and profuse tillering	Young seedlings (8-12 d) quickly and carefully transplanted	Up to 3-leaf stage; less than 15 days old
2	Wider spacing: less competition among plants for light and nutrients	More extensive and efficient use of sunlight and nutrients	Optimally wide spacing; one plant per hill in square pattern. Single seed-	25 x 25 cms to begin but wider if soil is more fertile
3	Reduce reliance on external inputs (new seeds, water, fertiliser, pesticides) and Enhance soil organic matter	Realise biological potential of rice plant and living soil system using optimal resources in a sustained way Feed the soil, so that it can feed the plants	Less chemical inputs Addition of in situ / ex-situ organic matter, as much as possible	At least use 25% of organic in combination of inorganic fertilisers
	Increase soil microbial activity	Realise biological potential of soils for better plant growth	Apply lot of organics and bio products	Green manure crops / use of green manure / azolla / incorporation of crop residues / compost / FYM / bio-fertiliser, etc

S.No	Principles	Rationale for the Principle	Best Practices	Desirable
4	Maintain mostly aerobic soil conditions and maintain Alternate wetting and drying	Prevent negative effects of submergence (hypoxia) suppressing roots and aerobic soil organisms; exit of toxic gases	Small quantity of water as per the requirement of the crop.	Irrigation water after hairline cracks develop in soil. Use of *Boumans* tube for correct time of water application
5	Use of Weeder instead of manual weeding	For creating aerobic, and effective weed management and incorporation of weeds as a source of organic manure.	Intercultivation actively aerating soil with weeder, atleast 3 times in growing period, starting from 10th day after trans - planting at 10-12 day interval.	Using weeder at 10 day intervals 2 to 4 times, with 1st use 10-12 days after transplanting. Different and suitable weeders for soil conditions may be used.
6	Promote healthy root growth	Reverse the inhibition of root growth caused by current normal paddy cultivation practices due to hypoxic condition.	Transplanting that does not invert the seedling root tip upwards careful transplanting at shallow depth.	Careful transplanting is crucial to start the process, keeping soil and seed sac attached to roots. Irrigation water after hairline cracks develop in soil.

Introduction of SRI in India

SRI was introduced in India in the year 2000 when researchers at the Tamil Nadu Agricultural University (TNAU) initiated experiments involving SRI principles in a collaborative project on growing rice with less water. TNAU results in 2000-02 were followed by evaluations on farmers' fields. In 2003 a package of SRI practices was evolved and tested in 200 farmers' fields through a state government initiative to compare the performance of SRI and conventional cultivation in the Cauvery and Tamiraparani river basins. The results showed an average increase in grain yield by 1.5 tons/ha in both basins with reduced input requirements, and even an 8% reduction in labor needed per hectare. This evaluation provided a basis for officially recommending SRI adoption to farmers in 2004 (Shambu, 2007).

Concurrently, the state agricultural university in Andhra Pradesh, Acharya N.G. Ranga Agricultural University (ANGRAU), introduced SRI in farmers' fields during *kharif* season 2003, after ANGRAU scientists visited SRI, being implemented in Srilanka. Comparison trials were conducted in all districts of the state. These results generated nation wide interest as they showed average yield increases of 2.5 tons/ha (Table.3) i.e 50% over conventional irrigated rice cultivation (*WWF, 2008*).

Table 3. Grain yields in SRI recorded in experiments across India

S. No	Location	Grain Yield (tons/ha)			Source
		Conventional	SRI	% increase / decrease	
1.	Tamil Nadu Rice Research Institute, TNAU, Aduthurai	4.7	7.1	+48.9	Rajendran *et al.* 2005

Table 3. Grain yields in SRI recorded in experiments across India

S. No	Location	Grain Yield (tons/ha)			Source
		Conventional	SRI	% increase / decrease	
2.	14 Research stations, ANGRAU, Andhra Pradesh.	4.9	5.7	+16.6	Mallikarjuna Reddy *et al.* 2007
3.	Indira Gandhi Agricultural University, Raipur, Chattisgarh	5.9 (2006) 4.3 (2007)	6.6 5.1	+12.0 +17.8	Chitale *et al.* 2007
4.	Agricultural Research Institute, Patna, Bihar	3.9	6.1	+55.1	Ajaykumar *et al.* 2007
5.	Pandit Jawaharlal Nehru College of Agriculture and Research Institute,Karaikal, Puduchery	2.2	3.7	+68.3	Sridevi and Chellamuthu, 2007
6.	ICAR Research Complex, Umiam, Meghalaya	4.0 (2005) 4.7 (2006)	4.4 5.2	+9.3 +10.2	Munda *et al.* 2007
7.	Central Rice Research Institute, Cuttack, Orissa	4.9 (2005) 5.6 (2006)	5.9 7.0	+20.4 +25.0	Rao. *et al.* 2007
8.	Regional Agricultural Research Station, Shillongani, Assam	3.1	4.5	+45.2	Bora and Dutta, 2007
9.	Agricultural Research Station, UAS, Kathalagere, Karnataka	8.8 (2005) 9.1 (2006)	10.2 10.5	+15.9 +15.4	Jayadeva *et al.* 2008
10.	Main Rice Research Station, AAU, Bawagam, Gujrat	4.0 (2006) 4.7 (2007)	6.3 7.5	+35.9 +37.1	Chauhan *et al.* 2008
11.	Birsa Agricultural University, Ranchi, Jharakhand	4.3	5.0	+16.3	Singh *et al.* 2008
	Mean	4.94	6.30	27.8	

Source: More Rice with Less Water (WWF, 2008).

Bihar state had taken up SRI promotion during last 10 years (2006-2011) as single point agenda and promoting it in large scale with small and resource poor farmers and covered around 7.5 lakh ha during 2011-12. It was reflected in significant enhancement in the rice production of the state in the year 2012 (Wu and Uphoff 2015). In the state of Bihar, where nearly half the population of 100 million lives below the poverty line and 93% depend on growing rice and potatoes, endorsed adoption of SRI, saying its rice production increased to a record 8.2 m tones in 2012, against 3.1m tones in 2010-11. “The quantum jump is due to the use of the new SRI technique of rice production,” advertise by Finance minister https://www.theguardian.com/ world/2013/feb/ 23/india-rice-revolution-questioned, 2013.

The System of Rice Intensification (SRI), introduced into Andhra Pradesh in 2003 with systematic evaluation in on-farm comparison trials across all districts of the state (Satyanarayana *et al.* 2006), takes on greater significance within the above context of water limitations. The SRI method advocates synergies among the unconventional management practices that unlock the physiological potential of rice, with results that challenge prevailing notions of yield ceilings for this staple food crop (WWF-ICRISAT, 2010).

SRI method of cultivation has spread to states other than Andhra Pradesh, Tamil Nadu, Karnataka, West Bengal and Pondicherry. Research activity was reported in the state of Gujarat by the rice research station in 2004. SRI activities have largely been due to the initiative of a individuals from the agriculture department in states like Kerala in the south and Tripura in the North East. In both these states the officers concerned have pushed the agenda in the government, creating space for local training. (For more information ref the WWF project dialogue bulletins -13 nos http://www.iwmi.cgiar.org/dialogue/godavari/files/Jan06-Bulletin Final.pdf and http:/www.iwmi.cgiar.org/dialogue / godavari / files / Dialogbulletin April06.pdf 26).

The slightly modified System of Rice Intensification (SRI) method has gained acceptance and yielding results in paddy cultivation in Krishna district. Over 31,000 hectares of land was brought under the SRI method in the *kharif* season of 2017/ All India Coordinated Rice Improvement Programme (September 23, 2017, The Hindu, (Andhra Pradesh, India)

Experiments under AICRIP on rice revealed that SRI had advantage over direct seeding as well as normal transplanting (Fig. 4).

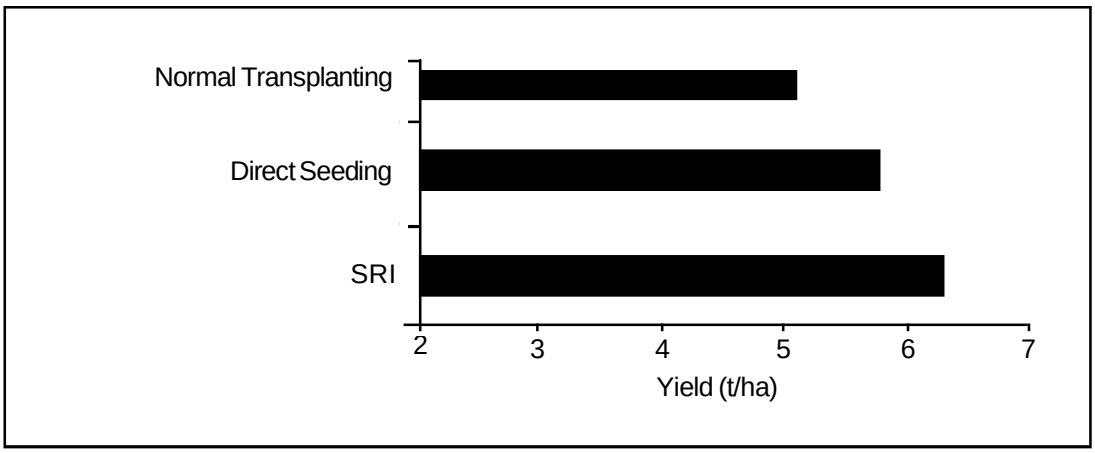


Fig.4. Comparison of different Crop establishment methods under AICRIP

Source: DRR, 2005-2014

The results of the long term experiment (3 wet seasons and 3 dry seasons) indicated superior performance of SRI over Normal Transplanting flooded (NT) on grain yield and water productivity. SRI method yielded 16-23 % higher grain yield with mean water saving to the tune of 18-32% during wet and dry season as compared to NT. Using intermittent irrigation, Thiyagarajan *et al.* (2002) reported a water saving of 50% over the traditional flooding without any adverse effect on grain yield and proved that SRI is not only seed saving but also water saving technology. The water saved for rice can be effectively used for increasing the area under rice or other irrigated dry crops in the cropping sequence for enhancing the system productivity. Hence, the better yields in SRI crop are due to its practices (young seedling, wider spacing, inter cultivation with weeder, saturation of soil without submergence and use of organics) taken together, create conditions in which beneficial for plant growth better tillering and yield attributes and yields. Further, SRI can greatly increase net benefits as it saves approximately 25-50% water over conventional flooded rice production thereby reducing production cost especially under water scarce conditions(Chapagain and Yamaji , 2010). Further, total nitrogen, organic carbon%, soil dehydrogenase, microbial biomass carbon, total bacteria, fungi, and actinomycetes were found higher in the two SRI plots in comparison to CT. It is concluded that SRI practices create favorable conditions for beneficial soil microbes to prosper, save irrigation water, and increase grain yield (Gopalakrishnan, *et al.* 2014).

Many experiments revealed the higher productivity and reduced seed rate and water use. The success of diverse SRI adaptations and innovations reveals the potentials of SRI being adapted and integrated to various environmental and agricultural systems in a cluster approach for enhancing the profitability of rural farmers of India as it is more

convenient to adopt small farmers with own family labour.

SRI Experiments were also conducted in Andhrapradsesh (Telangana and Coastal District) during past decade to assess the potential SRI with other crop establishment methods. The yield improvement was significant (19.9%) over other methods. Among the varieties the performance of BPT 5204 was promising (Table 4 and 5).

Table 4 . Grain yield and yield attributes under irrigated transplanted conditions with different establishment methods (mean of three years 2005, 2006 and 2007).

Treatments	Rajendranagar				Maruteru			
	Panicles/ m^2	Panicle weight) (g	Grain yield (t/ha)	% increase	Panicles/ m^2	Panicle weight (g)	Grain yield (t/ha)	% increase
T1-Standard practice of transplanting	393	3.18	4.87	-	234.39	3.20	5.24	-
T2-System of rice intensification	514	3.75	5.84	19.91	231.56	3.64	5.32	1.52
T3-Integrated crop Management	439	3.30	5.20	6.77	235.30	3.49	5.29	0.95

Table 5. Yield attributes and yield of different genotypes under SRI system (Rajendranagar, 2008)

Geno types	Grain Yield (t/ha)	Panicles/m^2 (No.)	Panicle wt. (g)
Prassana	4.71	272	2.18
Shanti	4.39	280	2.17
IET 19421	4.95	288	2.43
Sugandhamathi	5.20	612	2.41
PA6201	6.52	344	3.20
PA6444	7.45	304	3.21
KHR-2	5.15	296	3.18
BPT-5204	5.06	312	2.55

Source: DRR, (2005-2008)

Research experiences of SRI across the country:

*Response of SRI method on grain yield across the locations***:** The results of multi location trials (MLT) clearly indicated that the performance of SRI varied from location to location indicating that response of SRI is location specific(Table 6). SRI recorded higher yield than Normal Transplanting (NTP) at half of the locations (10-12). The mean yield advantage of SRI over NTP ranged from 7-20 per cent irrespective of soil and locations across the years (Fig. 5). The mean grain yield increase in SRI method was 50 % in 19 locations where SRI performed consistently superior across 4 years This increase in grain yield under SRI could be attributed to profuse tillering, improved soil aeration achieved through the soil disturbance by cono weeder operation, in addition to effective weed suppression (Thiyagarajan *et al.* 2002 and 2005).

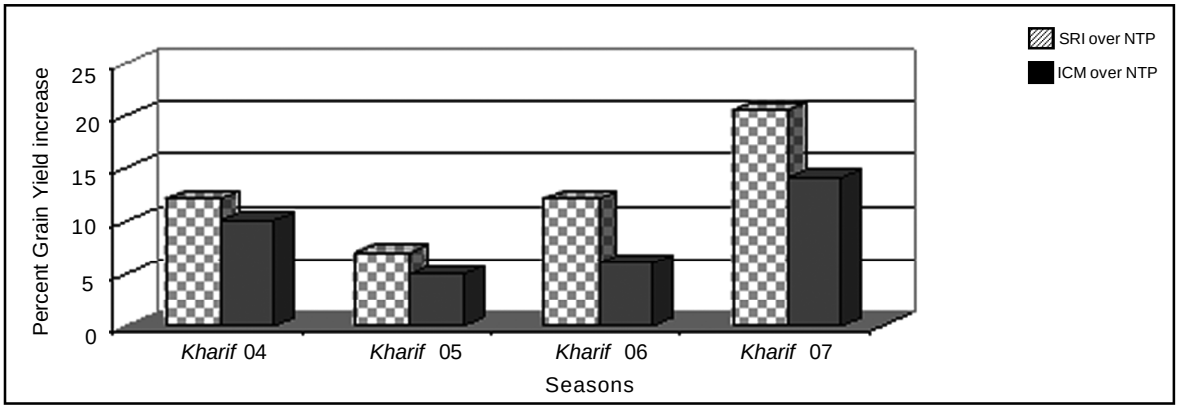


Fig 5. Grain yield increase with SRI and ICM over NTP across the locations (*Kharif* 2004-07)

Table 6. Performance of SRI in different locations across India

S. No.	Item	Performance	No. of locations	Name of the locations
1.	SRI superior over standard Transplanting(ST)	50% or more yield advantage	19	Aduthurai, ARI-R'Nagar, Arundhatinagr, Jagdalpur, Kapurthala, Patna, Rajendranagar, Siriguppa, Titabar, Chatha, Coimbatore, Pantnagar, Umiam, Malan, Mandya, Maruteru, Nawagam, Pusa
2.	ST over SRI	5-10% yield advantage	3	Kapurthala, Karaikal, Sabour

Source: (DRR Progress reports , 2004-2007)

Nursery area and seed saving:

As a result of adopting wider spacing and planting of a single seedling/hill at a spacing of 25 x 25 cm there would be only 16 hills/m^2 as against 44/ m^2 or more in the conventional method. Sufficient nursery required for one ha under SRI could be raised using just 5 kg seed as against 20-30 kg/ha under ST. In case of hybrids, 66% seed cost could be saved by adopting SRI method. The significant seed saving will promote seed multiplication rate, purity of seed (single seedling planting) and faster availability/spread of released varieties. Further the nursery area for SRI method is just 100 m^2/ha which is one tenth of area required for ST. There will be reduction in the cost of nursery preparation, labour saving and of inputs for nursery, mainly water which is scarce during the period of nursery raising in both the seasons.

Varietal response to SRI:

Contrary to the perception that SRI method is genotype neutral, significant differences were observed between the varieties under SRI. In general, it was observed that hybrids (4 - 42% yield advantage) performed better over the varieties (2 -17%) under SRI as against ST. The hybrids KRH2, HRI 126 and PHB-71 and DRRH2 performed better as compared to the varieties. BPT 5204 and MTU 1010 also performed well under SRI method in Andhrapradesh. Since seed requirement is quite low in SRI, this could be the best method for cultivating hybrids whose seed cost is relatively higher compared to inbreds. Most of the varieties generally performed better but there are reports that some varieties perform much better than others. Therefore, to identify the response of different genotypes to SRI practice at different locations, locally popular varieties of different duration were tested at 16 locations. Results indicated that there was a significant differential response of genotypes to SRI method of cultivation. Based on the mean over the locations and among the group of cultivars, the performance of late and medium duration varieties, and hybrids was found to be better as compared to early duration varieties at most of the locations . It is imperative that, under SRI method, due to wider spacing, those varieties which have high tillering ability perform better as compared to the shy tillering ones.

Saving in water:

Systematic studies conducted at Directorate of Rice Research by using digital water meters during wet and dry seasons 2006 and 2007, revealed that water saving in SRI could be up to 32%. SRI method received only 8906 m^3 of water which is 32% less of that for ST (13055 m^3/ha). Total water productivity of the SRI was 53% higher as compared to conventional method. (Table 7). SRI saved nearly 25% irrigation water without any penalty on yield compared to conventional transplanting (Chowdhary *et al.* 2005). Using intermittent irrigation, Thiyagarajan *et al.* (2002) reported water saving of 50% in SRI over the traditional flooding without any adverse effect on grain yield.

Table 7. Water productivity as influenced by conventional standard transplanting (ST) vs SRI method (Mean of *kharif* and *rabi* 2006-2007)

	Method	Quantity	Percent
Water applied (m^3/ha)	ST	13055	
	SRI	8906	32.0 (reduction)
Water Productivity (kg/m^3)	ST	0.32	
	SRI	0.48	53.0 (increase)
Unit Water requirement (l/kg)	ST	3125	
	SRI	2083	

Source . Mahender Kumar, 2013

Nutrient use efficiency and status of soil available nutrients:

The study conducted at DRR Farm, Ramachandrapuram on sandy clay loam soil with three varieties and three systems of crop establishment *viz*., SRI, Eco-SRI (nutrients supplied through organics) and ST indicated that SRI and ST were on par and significantly superior to ECO-SRI with respect to N, P and K uptake in both the *kharif* and *rabi* seasons. Though the nutrients uptake remained the same, nutrient use efficiency was marginally higher in SRI (by 8, 8 and 12% for N, P and K, respectively, during *kharif* and 5% for N during *rabi*) compared to ST (Table 8). The amount of accumulation of nutrients that leads to more vigorous plant growth and higher yields is due to changes in capacities of the plant itself, particularly its root system. Barison, (2002) found considerably higher concentration of N, P and K in the foliage at late stage, reflecting better uptake of nutrients at later stages in SRI method. Soil analysis data indicated similar available nutrient status in SRI and ST after two seasons of experimentation. Thus, SRI resulted in higher productivity during *kharif*, similar nutrient uptake and marginally higher nutrient use efficiency without depleting the soil available nutrients compared to standard transplanting, after two seasons.

Table 8. Soil properties after 2 seasons as influenced by different crop cultivation methods

Treatments	pH	EC (dS/m)	SOC (%)	Available N (kg/ha)	Available P_2O_5(kg/ha)	Available K_2O (kg/ha)
Eco-SRI	8.51	0.50	1.10	247.0	204	674
SRI	8.43	0.51	1.25	272.0	258	638
ST	8.44	0.51	1.18	251.0	256	609
Mean	8.44	0.51	1.18	257	239	641
C.D(0.05)	NS	NS	NS	NS	26	34

Influence of SRI on incidence of insect pests:

Field experiments were conducted in dry and wet seasons in 2005 and 2006 at Directorate of Rice Research – Ramachandrapuram farm (Table 4 & 5). The pest incidence data indicated that yellow stem borer damage was high at all stages of crop growth period and its damage (dead hearts) was low in Shanti grown under SRI (7.0%) as compared to ST (11.4%). At reproductive stage, the damage (white ear heads) was high in SRI (28.3%) than conventional method (21.2%). The study through survey (SRI – adopted village) indicated that SRI had low pest incidence resulting in lower or no-pesticide application. The benefit cost ratio was higher for SRI method (1.77 and 1.76) in two villages (Katkur and Bonakallur) of Warangal district, Andhra Pradesh than conventional method (Padmavathi *et al.* 2008) (Table 9). Similar results of low pest incidence in rice grown under SRI due to vigorous and healthy growth of plant coupled with wider spacing has been reported by Gasperillo (2002), Gani (2004), Ravi *et al.* (2007). Therefore, even a small reduction in the pesticide usage will help in reducing the cost of cultivation.

Table 9. Cost of cultivation of paddy at two villages in Warangal district

S. No.	Village name (No of Farmers)	Method of rice cultivation	Cost of cultivation per acre (without pesticide)	*Cost of pesticide per acre	Total cost of cultivation	Grain yield	Gross income (Rs)	Net returns (Rs)
1	Katkur (60)	SRI	7777	11.76	7788.76	3600	21600	13811.2
		Conventional	8995	496	9491	2880	17280	7789
		Difference	1701	484.24	2185.24	720	4320	2134.76
2	Bonakallur (61)	SRI	7422.12	0	7422.12	3420	20520	13097.9
		Conventional	8883.85	457.04	9340.89	2940	17640	8299.11
		Difference	1461.73	457.04	1918.77	480	2880	

Reduction of the duration of the crop:

Field experiments were conducted for assessing the potential benefit of SRI especially in terms of reducing the duration of the crop. Three methods of crop establishment (SRI, SRI-eco and ST) were compared with three promising high yielding varieties (2 varieties and a hybrid) indicated that a mean reduction of days to 50% flowering was 11 days across seasons and varieties and also maturity of the crop. Further SRI method recorded higher grain yield in both the seasons (1.4 t/ha) with reduced duration of crop and helped to cultivate succeeding crop timely. Due to reduction in duration and increase in yields SRI recorded a higher per day productivity to an extent of 9.4 kg/ha/day and 21.7 kg/ha/day over ST during wet seasons of 2006 and 2007 respectively (Table 10). This also helped to reduce the water requirement and facilitates to avoid water stress specially rice grown in tail-end areas.

Table 10. Per day productivity of rice as influenced by methods of crop cultivation

2006 *kharif*				2007 *kharif*			
Methods	**DFF**	**Yield**	**per day yield**	**Methods**	**DFF**	**Yield**	**per day yield**
ECO-SRI	95	4783	39.0	ECO-SRI	95	3189	25.8
SRI	104	5267	39.2	SRI	104	5604	41.8

2006 *kharif*				2007 *kharif*			
Methods	**DFF**	**Yield**	**per day yield**	**Methods**	**DFF**	**Yield**	**per day yield**
Nor	115	4284	29.8	Nor	115	4874	33.7
CD(.05)	2	321	NS	CD(.05)	3	481	3.2
CV%	3	12	13.2	CV%	3	10	9.1
Varities							
BPT 5204	114	4320	30.1	BPT 5204	114	4812	33.3
DRR H2	94	4678	37.6	K.Hamsa	94	4390	35.4
Swarna	106	5336	40.1	KHR-2	106	4466	32.6
CD(.05)	2	148	3.6	CD(.05)	3	258	2.1
CV%	2	11	11.5	CV%	3	6	6.0

Eco-SRI- SRI method with organics

Further, SRI helps breeders to produce large quantities of breeders seed in short time as the quantity of nucleus (basic) seed of a new variety available is always less quantity and seed requirement for SRI is only 2 kg / acre. Therefore seed multiplication through SRI will be an added advantage for the breeders to popularize new cultures quickly.

Cost of cultivation and yield difference between SRI and Conventional method

A study was conducted to compare the economics of rice cultivation in five major rice growing states of India, viz., Chhattisgarh, Uttarakhand, Punjab, Madhya Pradesh, and Tripura, where SRI method of rice cultivation is in vogue. The results indicated the following trends:

The grain yield was 1724 Kg/ha for conventional method whereas it was 2466 kg/acre in SRI method of rice cultivation. Even though the total cost of cultivation was comparatively more in case of SRI, net income was more in SRI when compared to conventional method of rice cultivation and hence the benefit cost ratio was also more for SRI method i.e., 1:2.21 than the conventional method of rice cultivation i.e., 1:1.94. Further, the cost benefit analysis of individual components of SRI and Conventional transplanting clearly indicated superiority of SRI (Table 11).

Table 11. Comparative Economics of SRI versus Conventional methods of rice cultivation in selected states (Average of 5 states)

Particulars	SRI	Conventional
Grain yield (kg/acre)	6165	4310
Straw yield (kg/acre)	8300	7400
Grain value (Rs./acre)	49747	34000
Straw value (Rs./acre)	5325	4910
Total cost of cultivation (Rs./acre)	24905	20010
Gross income (Rs./acre)	55072	38310
Net Income (Rs./acre)	30165	18897
Cost : Benefit ratio	1:2.21	1:1.94

In general, the cost: benefit ratio is relatively higher for SRI as compared to conventional method due to reduced inputs coupled with higher grain yield

Socio-economic studies and frontline demonstrations :

Studies during the past 2 – 3 years have clearly indicated the superiority of SRI as a sustainable method of rice cultivation. Participant farmers could perceive a unique opportunity in SRI for increasing their income through higher productivity while saving on cost of seed/chemicals/water. Experiences with SRI conducted across several types of soils indicated that SRI may not be suitable in saline sodic soils due to less tolerance of rice at early seedling stages in these soil types.

Present status

SRI is getting popular in few states in India. It can be adopted in all those areas where there is water scarcity. Andhra Pradesh started in a big way during 2004-05, but Tamilnadu and Tripura have made good progress in adoption of SRI. Nearly 50% of rice area in Tripura and about 5 lakh ha of area in Tamil Nadu is reported to be covered with SRI method. Bihar state had also taken lead and implemented SRI in an area of 3.5 lakh ha in 2011 and 7.5 lakh ha during 2012. In India , nearly 10% of the rice area can be easily covered (4 m ha) with SRI and can create greater impact in terms of resource conservation and enhancing the productivity

Limitations of SRI technology:

It is difficult to adopt SRI in canal irrigation areas (unless the water is regulated as per the requirement) and adoption in large scale area in high rainfall, poor drainage and saline alkaline soils. Tank and tube well irrigated areas are most suitable.

However, adoption of SRI poses problems of

- Preparing suitable nursery bed;
- Transplanting of young seedlings along with soil to the main field;
- Water management and
- Use of cono weeder etc. when it is to be practiced on large scale by farmers.
- Lack of training and extension facilities: Training and extension facilities are not in place in many countries for SRI especially in India
- Changing the mind set of the farmers and inculcating the judicious use of Water
- Hands on support initially for SRI farmers

CONCLUSION

Rice management systems have been aimed mostly at maximising yield however there is a need focus towards the effective and economic utilisation of resources such as land, water and labour. A holistic system-based approach could help resolve the production constraints and deploy sustainable technological developments ' approach, integrating the available resource conservation (seed, water, labour and energy) will enhance the profitability of rice production. Moreover, institutional and policy support to farmers is crucial for ensuring SRI inputs and implements (such as, raised bed nurseries, markers, mechanical weeders, etc.,) for its wider adoptability.

Many agricultural establishments are still reluctant to recognise the potential of SRI. Preferences remain for emphasizing varietal improvement. Hybrid rice, for instance, which could result in 15-20% yield increases, but with higher costs, continues to receive major attention and publicity. There is need to go to the farmers with the good news that the SRI method also enhances rice yields to the tune of 5 t/ha. There should be no conflict between genetic and management approaches. Bihar state has shown the way during the past to enhance productivity of rice with SRI adoption and others can also follow the similar way.

SRI is the only technique available and our results showed that :

- Increase yields
- Reduce seed and nursery costs (68% reduction)
- Reduce labour requirements for planting
- Reduce weed management costs and drudgery to farm women
- Reduce irrigation water and power requirements (in bore well irrigated systems) and reduces the methane emissions
- It is a climate resilient technology for small and marginal farmers

Future line of work and up scaling of the SRI :

- SRI can play a major role in such a water scarce situation. The current crisis should serve as a timely wakeup call for governments
- Government should set a policy to adopt SRI nationwide. The goal should be to cover at least 25% of the irrigated rice area in the next five years. This needs to be supported by the allocation of exclusive funds. In Telangana state , rice cultivation is significantly practiced under bore well irrigation , SRI is highly suitable technology to enhance the productivity of rice and water saving
- Establish a systematic strategy for effective implementation, large scale capacity building and research backup. This should involve close collaboration among the state agricultural Departments, agricultural universities, public works departments, and civil society organisations.
- Give financial support to research on improving management practices, tools and economic evaluation at farm level.
- Provide farmers with subsidies for adopting SRI and incentives for saving water.
- Focus more on large scale adoption and involvement of the farmers for promoting SRI
- SRI principles can also be tried in other crops and system based approaches will enhance the profitability of the small scale farmers

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STUDIES ON COMBINING ABILITY OVER ENVIRONMENTS IN HYBRID RICE (*Oryza sativa* L.)

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ABSTRACT

A field investigation was carried out to identify effective restorers and maintainers to use in hybrid rice breeding programme. In this study 36 hybrids were developed by crossing three wild abortive based CMS lines with 12 restorers in line x tester design. The pooled analysis of variance over locations indicated that mean squares due to environments were significant for all the traits except for days to 50% flowering and 1000 grain weight, while crosses exhibited significant differences for all the traits studied. Line x tester effect showed significant differences for the traits studied except for days to 50 % flowering. Specific combining ability variance was higher than the general combining ability variance for the traits studied except for days to 50% flowering. This indicated the predominance of non-additive gene action in controlling these traits. The lines IR-58025A, IR-79156A and the testers RNR-15048, RNR-2781 were found to be good general combiners for most of the yield contributing traits. The testers IR-83142-B-57-B, D-4098 and RNR-15351 exhibited earliness and short stature. The hybrids IR-79156A x NWGR-3132 and IR-79156A x RNR-2456 were found to be good specific combiners over the environments for grain yield per plant, number of productive tillers per plant, panicle length and number of filled grains per panicle. These hybrids could be utilized for exploitation of heterosis for grain yield in hybrid rice.

Rice is one of the most important food crops of India in terms of area, production and consumption. In India, rice is grown in an area of 43.39 m ha with the production and productivity levels of 104.32 mt and 2404 kg / ha, respectively during 2015-16 (Agricultural Statistics at a Glance, 2016). The estimated rice requirement in India by 2025 is about 130 mt. Hybrid rice is the best practically feasible options available to increase the production. For the development of rice hybrids through cytoplasmic genetic male sterility, identification of maintainers and restorers from the local elite lines is utmost important. Selection of parents is most important criteria in hybrid development programme since *per se* performance of parents is not always a true indicator of its combining ability in hybrid combination (Dushyanth Kumar and Chandrappa, 1994). Combining ability studies helps to identify the better combiners which can be hybridized to exploit heterosis and to select better crosses. The present investigation was carried out to study the nature of gene action and to identify the best general and specific combiners for hybrid rice breeding programme.

MATERIAL AND METHODS

In the present study, three wild abortive based CMS lines were crossed with twelve restorers in Line x Tester design during *rabi*, 2013-14 at Rice Research Centre, Rajendranagar, Hyderabad. The resultant 36 hybrids along with their parents and two checks (MTU-1010 and KRH-2) were evaluated in three diverse agro-climatic locations *viz*., SRTC, Rajendranagar; RARS, Jagtial and ARS, Kampasagar during *kharif*, 2014. The trial was laid out in randomized block design with three replications. Each entry was planted in a row of 4 m length with a spacing of 20 cm between rows and 15 cm between plants. Data was recorded for eight quantitative traits by randomly selecting five plants from each entry in each replication. Observations were recorded for days to 50% flowering, plant height (cm), number of productive tillers per plant, panicle length (cm), number of filled grains per panicle, spikelet fertility (%), 1000 grain weight (g) and grain yield per plant (g). Pooled data obtained from three locations were subjected to statistical analysis as per Kempthorne (1957) to estimate combing ability effects.

RESULTS AND DISCUSSION

The pooled analysis of variance over three locations revealed that mean squares due to environments were significant for all the traits except for days to 50% flowering and 1000 grain weight and crosses exhibited significant differences for all the traits studied (Table-1). Line x tester effect exhibited significant

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differences for the traits studied except for days to 50 % flowering. Variance of *sca* was higher than *gca* variance for the traits studied except for days to 50% flowering. It indicates the predominance of non-additive gene action in the inheritance of these traits. Padmavathi *et al*. (2013) and Bineeta Devi and Lal (2015) also found non additive gene action in their studies.

The line IR-58025A had higher *per se* performance for number of productive tillers per plant, spikelet fertility (%) and grain yield per plant, while the line IR-79156A was found to be good for panicle length and number of filled grains per panicle (Table-2). The testers, RNR-15028, RNR-15398, RNR-15038, RNR-2781 and RNR-15351 recorded high *per se* values for grain yield per plant. The hybrids, IR-58025A x RNR-15038 (47.37 g),IR-79156A x NWGR-3132 (44.83 g), IR-58025A x RNR-2781 (44.51 g), IR-79156 A x RNR-2781 (44.12 g), IR-58025A x RNR-15028 (41.27 g) and IR-79156 A x RNR-15038 (40.95 g) were proved to be better as they recorded high *per se* performance for grain yield per plant. These hybrids also proved its performance in some of the yield component traits such as number of productive tillers per plant, number of filled grains per panicle and panicle length.

The line IR-58025A was found to be good general combiner for number of productive tillers per plant, panicle length and grain yield per plant and the line IR-79156A showed superior *gca* effect in desirable direction for plant height and number of filled grains per panicle (Table-3).The line IR-80555A exhibited significant *gca* effect in desirable direction for days to 50% flowering, plant height, spikelet fertility (%) and 1000 grain weight. Among the testers studied, RNR-15038 and RNR-2781 showed significant *gca* effect in desirable direction for number of productive tillers per plant, panicle length, number of filled grains per panicle, spikelet fertility (%) and grain yield per plant. The testers, IR-83142-B-57-B, D-4098 and RNR-15351 exhibited earliness and short stature but these were found to be poor general combiners for most of the yield components studied. The tester NWGR-3132 and RNR-15028 had significant *gca* effects for number of filled grains per panicle and grain yield per plant. In the present study, good combiners for earliness and short plant type did not exhibit good combining ability for grain yield and its component traits.

Estimates of *sca* effects across the locations were presented in Table-4. Out of 36 crosses evaluated, the hybrids, IR-79156A x NWGR-3132 and IR-79156A x RNR-2456 were found to be good specific combiners for number of productive tillers per plant, panicle length, number of filled grains per panicle and grain yield per plant. Though the hybrid, IR-80555A x RNR-2458 had positive significant *sca* effect for number of productive tillers per plant, panicle length and number of filled grains per panicle but grain yield per plant was not significant. It may be due to highly significant negative *sca* effect of test weight. The cross combinations IR-80555A x WGL-3962 and IR-80555A x RNR-15028 were found to express earliness with positive *sca* effects for grain yield per plant. Ten hybrids exhibited negative *sca* effect for plant height which is a desirable trait for development of non-lodging hybrids. Spikelet fertility (%) plays an important role in success of hybrid rice. Six hybrids recorded significant positive *sca* effect for spikelet fertility (%) and the hybrid IR-80555A x RNR-2781 showed highly significant *sca* effect for this trait. For grain yield per plant, 11 hybrids recorded positive *sca* effect and the hybrids, IR-79156A x NWGR-3132 (11.25), IR-79156A x RNR-2456 (7.86), IR-58025A x RNR-15398 (6.45) and IR-80555A x RNR-15351 (4.50) expressed high significant positive *sca* effect. These hybrids also proved its performance in one or more yield component traits. The parents of these crosses exhibited either low x high or low x low *gca* status. The crosses with low × high combiners resulted in superior combinations which may be due to complementary gene action and superiority of low x low combinations because of accumulation and interaction between favorable genes contributed by parents. It is not necessary that the parents involved in the cross combinations should have high *gca* effects to get significant *sca* effects. The reason ascribed is due to positive interaction between nuclear and cytoplasmic genes appear to be important than the interaction between nuclear genes alone. An ideal combination to be explored is one where high magnitude of *sca* is present, in addition to high *gca* effect in both or at least one of the parents. Similar results were reported by Tiwari *et al*. (2011), Thakare *et al*. (2013), Dorosti and Monajjem (2014) and Kumari Priyanka *et al*. (2014).

The study reveals that *sca* effects and *per se* performance of the crosses were not closely related. The crosses with high *per se* performance need not be the one with high *sca* effects and vice versa. The hybrids IR-79156A x NWGR-3132 and IR-79156A x RNR-2456 could be utilized for exploitation of heterosis in rice for grain yield.

Table 1. Analysis of variance for yield and yield contributing characters pooled over locations in Rice

Source of variations	Degrees of freedom	Days to 50 % flowering	Plant height (cm)	No. of Productive tillers/plant	Panicle length (cm)	No. of filled grains/ panicle	Spikelet fertility (%)	1000 grain weight (g)	Grain yield / plant (g)
Replications	2	7.80	5.96	10.17**	4.35	140.52	4.79	0.07	4.52
Environments	2	11.76	4314.47**	109.78**	209.57**	15436.81**	405.47**	0.50	2859.63**
ReplicationsxEnvironments	4	9.85**	9.06	8.70**	1.72	48.81	4.43	0.32	5.37
Crosses	35	183.34**	662.70**	21.22**	19.92**	10198.93**	70.67**	77.66**	536.07**
Line effect	2	733.21**	1198.22	21.82	73.54*	6529.48	20.59	64.31	580.27
Tester effect	11	351.33**	1146.49*	27.11	22.50	20782.53**	156.69**	166.21**	1095.25**
Line x Tester effect	22	49.36	372.11**	18.23**	13.76**	5240.71**	32.22**	34.59**	252.47**
Env x Crosses	70	6.91	272.89**	5.13**	5.62**	709.34**	6.07	0.49	47.63**
Env x Line effect	4	2.60	232.82	11.90*	17.00*	506.63	15.26	0.20	88.85*
Env x Tester effect	22	9.71	314.10	6.11	3.37	850.84	3.67	0.69	74.57**
Env x L x T effect	44	5.90	255.92**	4.02**	5.71**	657.02**	6.44	0.41	30.41**
Error	210	8.44	15.80	1.54	1.60	108.81	5.32	0.38	5.04
Total	323	27.10	168.09	5.27	5.76	1426.67	15.03	8.78	89.49
σ^2GCA		7.91	17.13	0.34	0.69	200.70	1.23	1.70	12.34
σ^2SCA		4.55	39.59	1.85	1.35	570.21	2.99	3.80	27.49
GCA/SCA		1.74	0.43	0.18	0.51	0.35	0.41	0.45	0.45

* Significant at 5 % level, ** Significant at 1 % level

Table 2. Mean performance of parents and crosses pooled over environments in Rice

Parents / Crosses	Days to 50 % flowering	Plant height (cm)	No. of Productive tillers/plant	Panicle length (cm)	No. of filled grains/ panicle	Spikelet fertility (%)	1000 grain weight (g)	Grain yield / plant (g)
Lines								
IR-58025A	98.22	85.35	13.82	24.20	179.97	88.95	19.60	27.40
IR-79156 A	98.89	96.35	11.12	24.26	188.11	86.60	19.64	25.22
IR-80555A	97.00	81.38	10.29	20.31	172.56	85.64	20.14	17.46
Testers								
RNR-15351	103.22	98.19	9.63	21.73	199.71	84.42	13.51	27.07
WGL-3962	109.44	107.96	8.93	24.63	135.17	84.35	23.82	21.77
IR-83142-B-57-B	98.33	100.12	8.70	24.75	126.17	89.70	19.62	17.74
RNR-15398	110.56	116.51	10.93	23.30	196.86	85.51	15.75	32.66
D-4098	97.00	95.30	9.12	24.16	121.56	93.99	26.71	26.58
NWGR-3132	108.67	99.36	9.15	22.34	120.16	89.69	22.08	24.23
RNR-15028	96.56	94.52	10.25	21.00	188.50	91.14	18.39	35.06
RNR-15038	108.33	110.66	9.99	23.77	224.10	91.28	16.15	32.49
RNR-2458	108.33	105.04	8.90	21.98	197.61	86.45	15.79	27.44
RNR-2456	107.89	97.10	8.31	19.63	123.66	84.56	18.80	20.99
RNR-17462	114.33	110.60	8.14	20.72	160.82	84.14	16.29	23.84
RNR-2781	114.33	115.99	10.10	22.86	174.13	86.62	13.75	27.43
Crosses								
IR-58025A x RNR-15351	104.11	99.91	11.29	24.27	144.32	83.97	18.15	27.05
IR-58025A x WGL-3962	104.33	94.18	10.82	24.58	161.71	88.38	21.97	30.79

Parents / Crosses	Days to 50 % flowering	Plant height (cm)	No. of Productive tillers/plant	Panicle length (cm)	No. of filled grains/ panicle	Spikelet fertility (%)	1000 grain weight (g)	Grain yield / plant (g)
IR-58025A x IR-83142-B-57-B	92.56	101.15	10.17	23.50	141.53	83.91	24.49	26.34
IR-58025A x RNR-15398	104.11	114.29	11.02	25.12	212.36	85.62	17.48	33.72
IR-58025A x D-4098	95.89	96.26	7.66	25.06	128.75	86.43	22.20	25.86
IR-58025A x NWGR-3132	104.22	104.52	10.04	24.13	183.19	85.50	20.97	27.03
IR-58025A x RNR-15028	102.89	106.98	12.92	25.44	209.27	88.73	19.13	41.27
IR-58025A x RNR-15038	107.56	105.44	13.50	26.54	240.54	88.55	17.80	47.37
IR-58025A x RNR-2458	105.56	101.47	10.56	25.38	168.02	85.80	18.48	28.61
IR 58025 A x RNR-2456	102.78	103.65	11.27	23.27	173.26	86.98	16.81	32.21
IR-58025A x RNR-17462	104.78	106.73	10.67	25.62	180.07	86.38	20.12	33.09
IR-58025A x RNR-2781	103.67	106.98	13.22	26.40	216.56	84.94	20.40	44.51
IR-79156 A x RNR-15351	98.33	95.83	9.07	24.46	193.42	85.82	15.18	21.13
IR-79156 A x WGL-3962	100.00	106.98	8.92	24.47	167.50	89.90	21.48	27.54
IR-79156 A x IR-83142-B-57-B	99.00	92.52	7.84	22.06	122.38	83.66	23.99	16.97
IR-79156 A x RNR-15398	101.00	112.62	9.72	22.91	168.71	82.38	18.24	21.09
IR-79156 A x D-4098	93.89	95.88	11.30	23.05	181.42	84.80	21.23	27.77
IR-79156 A x NWGR-3132	99.78	87.83	13.01	25.60	214.27	87.57	21.55	44.83
IR-79156 A x RNR-15028	96.67	96.36	8.57	23.20	205.29	91.16	19.83	29.04
IR-79156 A x RNR-15038	102.89	91.68	11.70	25.64	230.97	90.18	20.51	40.95
IR-79156 A x RNR-2458	104.67	81.76	7.06	22.52	150.05	83.27	20.79	22.74
IR-79156 A x RNR-2456	101.22	95.75	12.15	24.57	205.72	82.80	18.56	34.75
IR-79156 A x RNR-17462	105.22	114.21	10.72	24.24	201.29	83.48	20.97	29.70

Parents / Crosses	Days to 50 % flowering	Plant height (cm)	No. of Productive tillers/plant	Panicle length (cm)	No. of filled grains/ panicle	Spikelet fertility (%)	1000 grain weight (g)	Grain yield / plant (g)
IR-79156 A x RNR-2781	101.44	112.43	12.68	26.39	216.28	86.85	21.45	44.12
IR-80555 A x RNR-15351	94.67	90.25	11.41	22.42	185.62	82.59	19.68	27.88
IR-80555 A x WGL-3962	94.00	110.62	9.97	24.41	181.34	87.95	21.95	29.49
IR-80555 A x IR-83142-B-57-B	92.00	92.20	9.92	24.05	128.34	85.98	26.26	29.91
IR-80555 A x RNR-15398	102.67	96.78	10.69	23.33	141.35	83.43	18.71	19.35
IR-80555 A x D-4098	91.22	94.88	9.22	22.26	109.21	85.37	26.43	22.06
IR-80555 A x NWGR-3132	98.22	88.09	9.58	21.71	187.53	87.44	22.56	30.56
IR-80555 A x RNR-15028	91.33	95.23	11.01	24.47	200.09	92.04	22.08	38.19
IR-80555 A x RNR-15038	103.11	95.76	11.80	23.47	196.86	90.42	18.87	33.04
IR-80555 A x RNR-2458	103.33	91.10	10.97	25.18	216.60	82.66	12.67	23.60
IR-80555 A x RNR-2456	98.89	91.74	10.37	21.53	153.79	85.28	18.66	24.37
IR-80555 A x RNR-17462	98.89	102.67	9.76	20.61	144.44	85.90	21.82	26.06
IR-80555 A x RNR-2781	101.67	115.48	10.77	26.05	225.58	93.06	26.45	38.93
Checks								
KRH-2	100	109	10.30	22.30	139.62	85.33	22.96	32.03
MTU-1010	97	97	8.81	21.03	133.68	88.20	24.44	27.12
SEm	4.24	4.91	0.71	1.01	12.02	3.45	1.27	2.41
CD @ 5%	11.78	13.66	1.97	2.81	33.40	9.59	3.52	6.69

Table 3. Estimates of GCA effects across the environments for grain yield and yield components inRice

Parents	Days to 50 % flowering	Plant height (cm)	No. of Productive tillers/plant	Panicle length (cm)	No. of filled grains/ panicle	Spikelet fertility (%)	1000 grain weight (g)	Grain yield / plant (g)
Lines								
IR-58025A	2.52**	3.74**	0.50**	0.83**	-0.25	-0.10	-0.66**	2.55**
IR-79156A	0.16	-1.08**	-0.36**	-0.02	7.89**	-0.38	-0.18**	-0.56*
IR-80555A	-2.68**	-2.66**	-0.14	-0.82**	-7.65**	0.48*	0.85**	-1.99**
SE (Lines)	0.28	0.38	0.12	0.12	1.00	0.22	0.06	0.22
Testers								
RNR-15351	-1.14*	-4.40**	-0.01	-0.39	-5.76 **	-2.24**	-2.83**	-5.26**
WGL-3962	-0.73	4.20**	-0.69**	0.38	-10.03**	2.38**	1.29**	-1.34**
IR-83142-B-57-B	-5.66**	-4.44**	-1.29**	-0.91**	-49.46*	-1.85**	4.42**	-6.21**
RNR-15398	2.41**	8.17**	-0.12	-0.32	-6.07**	-2.55**	-2.35**	-5.89**
D-4098	-6.51**	-4.05**	-1.20**	-0.65**	-40.42*	-0.83	2.79**	-5.38**
NWGR-3132	0.55	-6.25**	0.28	-0.29	14.78**	0.47	1.19**	3.53**
RNR-15028	-3.21**	-0.21	0.24	0.26	24.67**	4.28**	-0.15	5.56**
RNR-15038	4.33**	-2.10**	1.74**	1.12**	42.58 *	3.35**	-1.44**	9.84**
RNR-2458	4.34**	-8.28**	-1.07**	0.25	-1.99	-2.46**	-3.18**	-5.63**
RNR-2456	0.79	-2.68**	0.67**	-0.99**	-2.62	-1.34**	-2.49**	-0.17
RNR-17462	2.78**	8.14**	-0.21	-0.62*	-4.95*	-1.12*	0.47**	-0.99*
RNR-2781	2.08**	11.90**	1.63**	2.17**	39.26*	1.92**	2.27**	11.90**
SE (Testers)	0.56	0.77	0.24	0.24	2.00	0.44	0.12	0.43

* Significant at 5 % level, ** Significant at 1 % level

Table 4. Estimates of SCA effects across the environments for grain yield and yield components in Rice

Crosses	Days to 50% flowering	Plant height (cm)	No. of Productive tillers/plant	Panicle length (cm)	No. of filled grains/ panicle	Spikelet fertility (%)	1000 grain weight (g)	Grain yield / plant (g)
IR-58025A x RNR-15351	2.55**	0.84	0.20	-0.28	-29.89**	-0.06	1.15**	-0.85
IR-58025A x WGL-3962	2.37*	-13.48**	0.41	-0.74	-8.23*	-0.27	0.83	-1.03
IR-58025A x IR-83142-B-57-B	-4.48**	2.13	0.36	-0.54	11.03**	-0.51	0.24	-0.61
IR-58025A x RNR-15398	-1.00	2.66*	0.04	0.50	38.47**	1.91*	0.00	6.45**
IR-58025A x D-4098	-0.30	-3.15*	-2.24**	0.77	-10.79**	1.00	-0.42*	-1.91*
IR-58025A x NWGR-3132	0.96	7.31**	-1.34**	-0.51	-11.56**	-1.24	-0.06	-9.66**
IR-58025A x RNR-15028	3.40**	3.72**	1.59**	0.24	4.64	-1.81*	-0.56**	2.56**
IR-58025A x RNR-15038	0.52	4.08**	0.67	0.49	18.00**	-1.06	-0.59**	4.37**
IR-58025A x RNR-2458	-1.49	6.29**	0.53	0.19	-9.95**	1.99*	1.83**	1.08
IR 58025 A x RNR-2456	-0.71	2.87*	-0.49	-0.69	-4.09	2.06**	-0.54**	-0.78
IR-58025A x RNR-17462	-0.71	-4.88**	-0.22	1.29**	5.05	1.23	-0.19	0.93
IR-58025A x RNR-2781	-1.11	-8.38**	0.50	-0.71	-2.67	-3.24**	-1.69**	-0.56
IR-79156 A x RNR-15351	-0.86	1.57	-1.16**	0.76	11.07**	2.07**	-2.31**	-3.67**
IR-79156 A x WGL-3962	0.40	4.13**	-0.62	0.01	-10.58**	1.53*	-0.14	-1.18
IR-79156 A x IR-83142-B-57-B	4.32**	-1.70	-1.10**	-1.12**	-16.27**	-0.48	-0.74**	-6.88**
IR-79156 A x RNR-15398	-1.75	5.79**	-0.39	-0.86*	-13.33**	-1.05	0.28	-3.07**
IR-79156 A x D-4098	0.06	1.28	2.27**	-0.40	33.73**	-0.36	-1.88**	3.09**
IR-79156 A x NWGR-3132	-1.12	-4.58**	2.50**	1.80**	11.38**	1.11	0.04	11.25**
IR-79156 A x RNR-15028	-0.46	-2.09	-1.90**	-1.15**	-7.49*	0.90	-0.33	-6.57**
IR-79156 A x RNR-15038	-1.79	-4.87**	-0.27	0.44	0.28	0.84	1.63**	1.05

Crosses	Days to 50 % flowering	Plant height (cm)	No. of Productive tillers/plant	Panicle length (cm)	No. of filled grains/ panicle	Spikelet fertility (%)	1000 grain weight (g)	Grain yield / plant (g)
IR-79156 A x RNR-2458	-0.01	-8.61**	-2.12**	-1.82**	-36.07**	-0.26	3.66**	-1.69*
IR-79156 A x RNR-2456	0.10	-0.22	1.25 **	1.46**	20.23**	-1.84*	0.73**	7.86**
IR-79156 A x RNR-17462	2.09*	7.41**	0.70	0.77	18.13**	-1.39	0.18	0.64
IR-79156 A x RNR-2781	-0.98	1.88	0.82*	0.13	-11.09**	-1.06	-1.13**	2.16**
IR-80555 A x RNR-15351	-1.69	-2.42	0.96 *	-0.48	18.82**	-2.02**	1.16**	4.51**
IR-80555 A x WGL-3962	-2.76**	9.36**	0.21	0.74	18.81**	-1.27	-0.69**	2.21**
IR-80555 A x IR-83142-B-57-B	0.16	-0.43	0.75	1.66**	5.24	0.99	0.49*	4.49**
IR-80555 A x RNR-15398	2.76**	-8.46**	0.35	0.36	-25.14**	-0.86	-0.28	-3.38**
IR-80555 A x D-4098	0.24	1.87	-0.03	-0.38	-22.94**	-0.64	2.29**	-1.18
IR-80555 A x NWGR-3132	0.16	-2.73*	-1.16**	-1.29**	0.18	0.13	0.02	-1.589*
IR-80555 A x RNR-15028	-2.95**	-1.63	0.31	0.92*	2.86	0.92	0.89**	4.01**
IR-80555 A x RNR-15038	1.28	0.79	-0.40	-0.93*	-18.28**	0.23	-1.04**	-5.43**
IR-80555 A x RNR-2458	1.50	2.32	1.58**	1.64**	46.03**	-1.73*	-5.49**	0.61
IR-80555 A x RNR-2456	0.61	-2.65*	-0.76	-0.77	-16.15**	-0.22	-0.19	-4.08**
IR-80555 A x RNR-17462	-1.39	-2.54	-0.48	-2.06**	-23.18**	0.17	0.01	-1.57 *
IR-80555 A x RNR-2781	2.09*	6.51**	-1.32**	0.59	13.76**	4.29**	2.83**	-1.60*
SE (Crosses)	0.97	1.33	0.41	0.42	3.48	0.77	0.21	0.75

* Significant at 5 % level, ** Significant at 1 % level

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EFFECT OF TIME OF SOWING ON GROWTH, YIELD AND ECONOMICS OF RABI PIGEONPEA [*Cajanus cajan* (L.) Millsp.] UNDER VARIED NUTRIENT LEVELS AND FOLIAR APPLICATION

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ABSTRACT

A field experiment was conducted during *rabi*, 2012-13 and 2013-14 at dryland farm of S. V. Agricultural College, ANGRAU, Tirupati (A.P) to study the effect of time of sowing, nutrient levels and foliar application. The experiment consisted of three dates of sowing (II FN of September, I FN of October and II FN of October) as main plots, three nutrient levels (10-40-0, 20-50-10 and 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} respectively) as sub-plots and two foliar applications, NAA @ 25 ppm and DAP @ 2 % applied once at 60 DAS and twice at 60 and 80 DAS as sub-sub plots and replicated thrice in a split-split design. Significant improvement in the growth parameters (plant height, leaf area and dry matter production), yield and economics of *rabi* pigeonpea was observed with the crop sown during II FN of September. Among the nutrient levels tested, 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} resulted in higher growth parameters, yield and economics of *rabi* pigeonpea than other levels. Application of NAA (25 ppm) and DAP (2 %) applied twice at 60 and 80 DAS resulted in higher growth parameters, yield and economics than single spray at 60 DAS. The study revealed that early sown crop during II FN of September receiving a nutrient dose of 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} along with foliar application of NAA (25 ppm) and DAP (2 %) twice at 60 and 80 DAS gave higher growth, yield and economics of *rabi* pigeonpea.

Pulses form an important group of food crops for nutritional security, sustainable crop production and soil health. Pigeonpea is one of the most promising legumes but the yield potentiality of this crop is very low in India. The main reasons are non-availability of high yielding disease resistant varieties and non-adoptation of proper agrotechniques for cultivation with inadequate fertilizer application. The full potential of redgram can be exploited by selecting suitable agrotechniques. Time of sowing, a non-monetary input has a considerable influence on growth and yield of crop. It ensures the complete harmony between vegetative and reproductive phases on one hand and climatic rhythm on the other hand. The timely planting of any crop is important for better plant growth, development and grain yield. Among various reasons for low productivity, role of nutrient supply in pulses is of paramount importance. Imbalanced nutrients use especially NPK and limited micronutrients have created concern in India as it may affect overall pulses productivity. Application of the nutrients through foliar spray at appropriate stages of growth becomes important for their efficient utilization and better performance of the crop. The advantages of foliar nutrition is it brings immediate improvement and is much effective than soil fertilization. Hence, the present study on effect of time of sowing on growth, yield and economics of *rabi* pigeonpea under varied levels of nutrients and foliar application was carried out.

MATERIAL AND METHODS

A field experiment was conducted on a sandy clay loam soil at dryland farm of S. V. Agricultural College, Tirupati, ANGRAU, for two consecutive *rabi* seasons of 2012-13 and 2013-14. The experiment was laid out in split-split plot design with 3 replications. The main plots comprised of 3 dates (T) of sowing *viz.,* II FN of September (T_1), I FN of October (T_2) and II FN of October (T_3), sub-plots, 3 nutrient (N) levels *viz.,* 10-40-0 (N_1), 20-50-10 (N_2) and 30-60-20 (N_3) kg N, P_2O_5 and K_2O ha^{-1} respectively and sub-sub-plots, 2 foliar (F) applications, *viz.,* NAA (25 ppm) and DAP (2 %) applied once (F_1) at 60 days after sowing (DAS) and twice at 60 and 80 DAS (F_2). The test variety was

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LRG-41 and was sown with a spacing of 45 cm x 15 cm (1,48,148 plants ha^{-1}). The soil was low in organic carbon and available nitrogen, medium in available phosphorus and potassium in both the years. The nutrients N, P_2O_5 and K_2O were supplied through urea, single super phosphate and muriate of potash, respectively to the respective treatments as basal. The weeds were managed using pre-emergence herbicide (imazythapyr @ 1.5 ml L^{-1}) with a spray solution of 500 L ha^{-1}. A total of two irrigations were given at the time of pod filling stage. Dimethoate @ 1.5 ml $L^{-1}$was sprayed against sucking pests at 55 DAS and Monocrotophos @ 1.5 ml L^{-1} + Dichlorvos @ 1.0 ml L^{-1} were sprayed against pod borer during 16th, 15th and 14th week after sowing in different times of sowing *i.e.* T_1, T_2 and T_3 respectively during both the years. Foliar application of NAA @ 25 ppm (25 mg L^{-1}) and DAP @ 2% (20 g L^{-1}) was done as per the prescribed treatments *i.e.,* at 60 and 80 DAS. The data collected on growth parameters, yield and economics were statistically analyzed as suggested by Panse and Sukhatme (1985). The gross returns was worked out based on the prevailing market rate of pigeonpea seed (30 kg^{-1}) at Agricultural Marketing Committee, Chittoor (Andhra Pradesh). The benefit: cost ratio was worked out for different treatments, by dividing the gross returns by corresponding cost of cultivation of the treatments.

RESULTS AND DISCUSSION

Growth parameters

Growth parameters (plant height, leaf area and dry matter production) at harvest were significantly influenced by the time of sowing, nutrient levels and foliar applications but their interaction effects were not significant in influencing the growth parameters, during both the years of study (Table 1). The tallest plant stature, with maximum leaf area and dry matter production were recorded in pigeonpea crop sown during II FN of September which was significantly higher than that sown during I FN of October. Significantly lesser stature of growth parameters (plant height, leaf area and dry matter production) were recorded in crop sown during II FN of October than that I FN of October. Early sown crop had longer vegetative lag phase which decreased progressively with delay in sowings up to II FN of October. Longer vegetative phase has the advantage of utilising growth resources for longer period of time leading to improvement in all the growth parameters like plant height, leaf area and dry matter production. In almost all the crops, growth, development and yield increases with increase in crop duration, especially duration of vegetative lag phase for efficient use of resources (Puste and Jana, 1990 and Patel *et al.* 2000). Plant height, leaf area and dry matter production increased significantly with increase in nutrient dose to 30-60-20 kg N, P_2O_5 and K_2O ha^{-1}, in both the years. Increase in growth parameters with higher nutrient dose can be attributed to the adequacy of NPK for meeting the crop needs (Milthrope and Moorby, 1979). Response of pigeonpea crop to relatively higher doses of NPK have been reported by Sarvaiya *et al.* (1993) and Singh and Pal (2003). Tallest plants with highest leaf area and dry matter production were recorded at foliar spray of NAA (25 ppm) and DAP (2 %) twice at 60 and 80 DAS, relative to the same foliar spray at 60 DAS alone, during both the years. This might be due to growth stimulatory effect of NAA and adequate supply of N and P (twice) even at latter phase of pigeonpea for improvement in photosynthetic activity resulting in enhanced growth parameters including plant height and leaf area production as evidenced from the strong relation between these with dry matter production (Reddy *et al.* 2006).

Seed yield

During both the years, highest seed yield of pigeonpea was recorded in crop sown during II FN of September, followed by that sown during I FN of October and II FN of October in the order of descent, with significant disparity between two of the three dates of sowing tested (Table. 2). Cumulative effect of improvement in growth and yield attributes resulted in significantly higher yield with earliest sown crop. Similar results of higher seed yield in early sown crop were also reported by Padhi (1995) and Laxminarayana (2003). Highest nutrient level of 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} respectively recorded significantly higher

seed yield relative to that due to 20-50-10 kg N, P_2O_5 and K_2O ha^{-1}. The lowest seed yield was realized with the pigeonpea crop receiving nutrient level of 10-40-0 kg N, P_2O_5 and K_2O ha^{-1}. Highest seed yield with higher nutrient dose was due to adequate supply of nutrients for optimum growth and development of the crop. The results are in conformity with the findings of Meena *et al.* (2013) and Umesh *et al.* (2013). Foliar application of NAA (25 ppm) and DAP (2 %) at 60 and 80 DAS resulted in significantly higher seed yield than that due to foliar spray at 60 DAS. Increase in leaf area, dry matter production and crop growth rate between 75-100 DAS improved the yield attributes like number of seeds pod^{-1} and test weight leading to higher seed yield due to NAA and DAP foliar application. The results are in accordance with that of Dixit and Elamathi (2007). Interaction between dates of sowing and nutrient doses and that between date of sowing and foliar applications were found significant in influencing the seed yield of pigeonpea. Crop sown during II FN of September receiving nutrient level of 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} resulted in significantly higher seed yield compared with that of other combinations tested. This might be due to the fact that the early sown crop recorded higher growth parameters and yield attributes than late sown crop, which could have utilized the nutrients efficiently at higher nutrient levels. Highest seed yield of pigeonpea was with the crop sown during II FN of September with foliar application of NAA and DAP at 60 and 80 DAS, might be due to optimum availability of nitrogen and phosphorus from flower bud initiation to seed development stage. Highest nutrient dose of 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} along with foliar application of NAA and DAP at 60 and 80 DAS resulted in significantly higher seed yield than the other combinations. With regard to the interaction of date of sowing, nutrient dose and foliar application, the highest seed yield was realized with the crop sown during II FN of September receiving nutrient level of 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} along with foliar application of NAA and DAP at 60 and 80 DAS. This might be due to the fact that early sown crop have enjoyed all the favourable conditions as it was sown during optimum time, with optimal availability of nitrogen and phosphorus from sowing to the seed development stage.

Economics

Significantly highest gross and net returns and benefit: cost ratio were recorded in to II FN of September sowing during both the years (Fig 1). Lowest gross and net returns and benefit: cost ratio were with late sown crop during II FN of October. Significantly, higher gross returns, net returns and benefit: cost ratio were recored at highest nutrient dose of 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} compared with the two lower nutrient doses tried. Foliar application of NAA (25 ppm) and DAP (2 %) twice at 60 and 80 DAS resulted in significantly higher gross and net returns as well as benefit-cost ratio compared with that due to same foliar spray at 60DAS alone, during both the years. Crop sown during II FN of September with 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} recorded significantly higher gross and net returns as well as benefit: cost ratio. Highest gross and net returns were recorded in crop sown during II FN of September with foliar spray of NAA (25 ppm) and DAP (2 %) twice at 60 and 80 DAS which was significantly higher than that with all other combinations. The highest gross returns, net returns and benefit: cost ratio in the above said interactions were due to highest seed yield obtained in the respective combinations.

CONCLUSION

The present study revealed that pigeonpea sown during II FN of September, supplied with 30-60-20 kg N, P_2O_5 and K_2O ha^{-1} along with foliar spray of NAA (25ppm) and DAP (2%) at 60 and 80 DAS gives optimum yield.

Table 1. Plant height, leaf area and dry matter production (DMP) of pigeonpea at harvest as influenced by varied times of sowing, nutrient levels and foliar applications

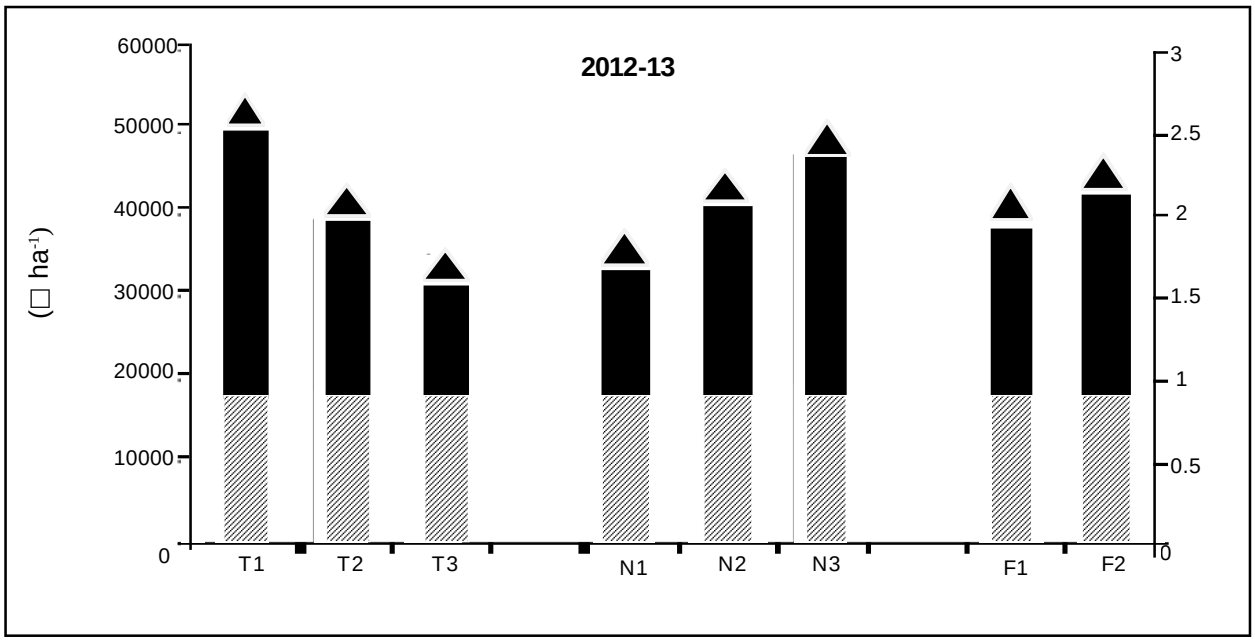
	Plant height (cm)		Leaf area (cm^2)		DMP (kg ha^{-1})	
	2012	2013	2012	2012	2013	2012
Times of sowing						
II Fortnight of September	170.8	173.3	720	761	14394	14412
I Fortnight of October	129.6	139.0	556	458	9024	8983
II Fortnight of October	115.0	120.7	422	355	5663	5726
Nutrient levels						
10-40-0 kg N, P_2O_5 and K_2O ha^{-1}	131.7	138.4	464	424	8744	8792
20-50-10 kg N, P_2O_5 and K_2O ha^{-1}	138.4	144.5	572	522	9733	9727
30-60-20 kg N, P_2O_5 and K_2O ha^{-1}	145.3	150.1	662	628	10604	10601
Foliar applications						
Foliar spray of NAA (25ppm) and DAP (2%) at 60 DAS	136.6	142.6	531	491	9466	9479
Foliar spray of NAA (25ppm) and DAP (2%) at 60 and 80 DAS	140.4	146.0	601	558	9921	9934

	SEm±	CD (P=0.05)	SEm±	CD (P=0.05)	SEm±	CD (P=0.05)	SEm±	CD (P=0.05)	SEm±	CD (P=0.05)	SEm±	CD (P=0.05)
T	1.33	5.2	2.71	10.6	31.2	122	22.9	90	91.9	359	140.9	550
N	1.25	3.9	1.05	3.1	21.5	66	25.6	79	90.2	278	62.4	192
F	0.70	2.1	1.08	3.2	10.3	31	14.8	44	76.1	226	136.7	406
T x N	2.17	NS	1.76	NS	37.3	NS	44.3	NS	156.2	NS	108.0	NS
T x F	1.20	NS	1.87	NS	17.9	NS	25.6	NS	131.8	NS	236.7	NS
N x F	1.20	NS	1.87	NS	17.9	NS	25.6	NS	131.8	NS	236.7	NS
T x N x F	2.09	NS	3.23	NS	31.0	NS	44.3	NS	228.3	NS	410.0	NS

Table 2. Seed yield (kg ha^{-1}) of *rabi* pigeonpea as influenced by varied times of sowing, nutrient doses and foliar sprays (Pooled analysis)

		F_1	F_2	Mean for T	Mean for N
T_1	N_1	1371	1504	1700	1127
	N_2	1650	1809		
	N_3	1863	2000		
T_2	N_1	975	1145	1329	1379
	N_2	1245	1407		
	N_3	1521	1680		
T_3	N_1	794	973	1067	1589
	N_2	1065	1096		
	N_3	1187	1285		
Mean for F		1296	1433	-	-

	SEm ±	CD (P = 0.05)
T	36.8	144
N	10.3	321
F	3.6	11
T x N	17.8	55
T x F	6.3	19
N x F	6.3	19
T x N x F	10.8	32



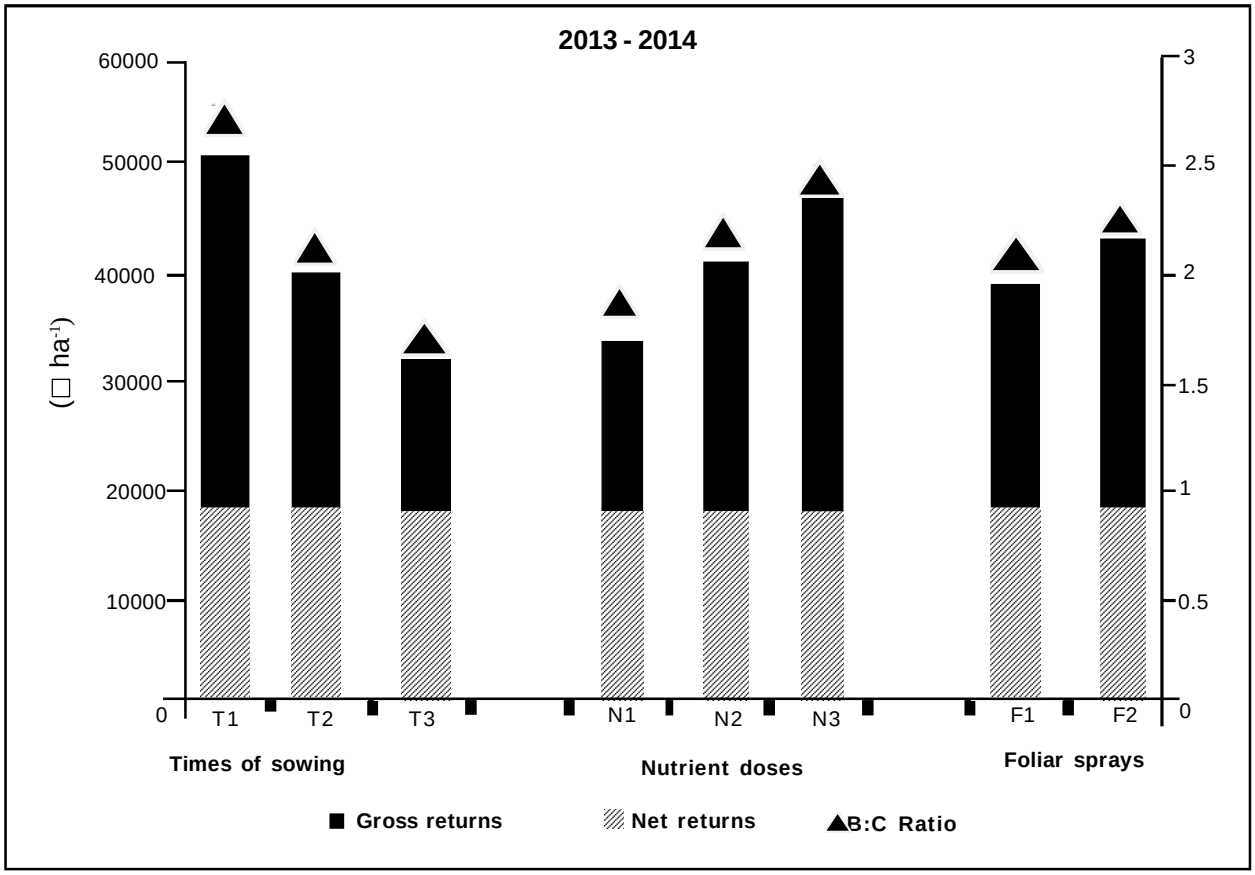


Fig. 1 : Economics of *rabi* redgram as influenced by varied times of sowing, nutrient doses and foliar sprays

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RED GRAM PRODUCTIVITY ENHANCEMENT THROUGH FRONT LINE DEMONSTRATIONS IN PRAKASAM DISTRICT OF ANDHRA PRADESH

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ABSTRACT

The present investigation was carried out in Prakasam District of Andhra Pradesh during the year 2014-15. Thirty Front Line Demonstrations were conducted during 2013-14 in *Kharif* season in three villages (Cumbum, Bestavaripeta and Pusalapadu) of 3 major redgram growing mandals. Demonstrations were organized in 12 hectares under redgram with best management practices using high yielding variety LRG 41. Ninety farmers participated in redgram demonstrations (10 demonstration farmers and 20 other farmers from each village) were purposively selected for the study. The results of demonstrations showed that farmers could increase the redgram productivity notably by switching over to improved variety and adoption of improved production technology. There was an yield increase of 26.67 per cent, decreased cost of cultivation of 30.77 per cent and increased net returns of 38.86 per cent in demonstration plots over control plots. The average CB ratio recorded in demo units was 1: 3.7 over 1:1.25 in farmers practice. Regarding the effect of FLDs on adoption of demonstrated practices almost sixty per cent (56.67%) of the farmers not adopted recommended High Yielding Variety before conducting demonstrations whereas more than eighty per cent of them have adopted LRG 41 variety after demonstration. With respect to seed treatment great majority (91.11%) have not adopted seed treatment, but after realizing the benefit almost seventy seven per cent of them were adopting seed treatment. Cent per cent of the farmers were not using neem oil as a prophylactic spray previously but sixty one per cent of them were adopting neem oil spray as prophylactic against *Maruka* after participating in demonstrations. Regarding need based pest and disease management, eighty four per cent of the farmers were going for indiscriminate sprays before organizing demonstrations, but sixty eight per cent of them switched over to need based sprays after noticing the results in demonstrated plots. Majority of the redgram farmers expressed production constraints like flower drop due to continuous dry spell (87.77%), poor seed quality supplied by Govt. agencies (84.44%), severe incidence of *Maruca* and pod fly (80.00%), increased cost of cultivation (73.33%), severe wilt problem (58.88%) and non availability of drought tolerant varieties (51.11%)

World wide Redgram was grown in about 4.23 million hectares with a production and productivity of 4.68 million tons and 751kg/ha respectively (Govind pal *et al*, 2016). Redgram in India is the most important pulse crop which is cultivated in the gross cropped area (3.81million ha) under pulses and providing 20% of the national pulse production. About 90% of the global pigeonpea area falls in India, corresponding to 93.00 per cent of the global production (FAOSTAT 2011).The production and productivity of Redgram in our country are 3.07 million tons and 806 kgs/ha, respectively (Government of India, 2013). In India, Redgram ranks second i.e. next to chickpea among important pulse crops. In addition to being an important source of human food and animal feed, Redgram also plays an important role in sustaining soil fertility by improving physical properties of soil and fixing atmospheric nitrogen. Being a drought resistant crop, it is suitable for dry land farming and predominantly used as an intercrop with other crops. Redgram is one of the most important legumes grown in Andhra Pradesh with an area of 5.37 lakh ha, 1.29 lakh tones production and 585 kg/ha productivity. It is largely grown in Prakasam district of Andhra Pradesh in an area of 55,891 ha. predominantly under rainfed cropping situation. The pulse production in the country can be sustained through productivity growth. The productivity can be increased with the increase of the level of knowledge and adoption of recommended technology. In this context, Front Line Demonstrations (FLDs) and trainings on recommended Redgram production technology were implemented by Krishi Vigyan Kendra (KVK), Darsi in Prakasam district during the year 2013-14 with the twin objectives of minimizing productivity with maximized adoption of critical interventions. With this background in view, to know the effect of FLDs and trainings on productivity and adoption levels of farmers, this particular study was taken up with the following specific objectives.

1. To analyze the effect of Front Line Demonstrations on productivity enhancement
2. To analyze the effect of Front Line Demonstrations on adoption of critical interventions by the farmers
3. To elicit constraints of farmers in redgram production

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MATERIAL AND METHODS

The present study was conducted during 2014-15 in Prakasam district of Andhra Pradesh three villages namely Viz., Tarlupadu, Cumbum, and Pusalapadu were purposively selected as Redgram FLDs were organized in these areas. From each of selected village 10 FLD farmers and 20 other farmers participated in demonstrations and trainings were selected. Thus a total of 90 Redgram farmers were selected for the study. Effect of the FLDs was studied in terms of yield increase, decreased cost of cultivation, increased net returns and CB ratio over control. To analyze the effect of FLDs on adoption levels five critical interventions viz., recommended variety, seed treatment, timely fertilizers, neem oil as prophylactic spray for Maruca and need based pest and disease management demonstrated were considered. Adoption was operationalized for the purpose of investigation as practicing the recommended production technology by the respondents. The data on adoption levels were collected from the selected Redgram farmers through personal interview technique by using the pre-tested schedule before and after organizing FLDs. To analyze the constraints faced by Redgram farmers, open ended questions were used and based on the frequency and percentages major constraints were identified.

RESULTS AND DISCUSSION

Details of the critical interventions demonstrated through FLDs

From Table 1, it could be inferred that High Yielding Variety (LRG 41), seed treatment (with 10 gm Trichoderma viride/kg seed), timely fertilizer management (50kgs DAP as basal per 0.4 ha), neem oil as a prophylactic spray (1lt/0.4 ha) and need based pest and disease management were the critical interventions demonstrated through Front Line Demonstrations after analyzing adoption gaps in redgram production technology. Thirty FLDs were carried out (10 FLDs in each village). The area of demonstration was 0.4ha and critical inputs were given to the demo farmers.

Table 1. Details of the demonstrations organized

Crop	Variety	Farming situation	Area covered (ha)	Number of the farmers	Critical inputs given
Redgram	LRG 41	Red soils, rainfed	12	30	1. Seed (LRG 41) 2. Seed treatment chemical (Trichoderma viride 10g/kg seed) 3. Fertilizer (50 kgs DAP/0.4ha) 4. Neem oil 5. Dichlorovos 6. Novoluran

Table 2. Details of Extension Activities organized

S.No	Extension Activity	No. of Programmes	No. of Participants	Title of the programme
1	Training programme	2	30	Production technologies in Red gram
			30	Integrated Pest & disease management in Red gram
2	Field Day	2	58 59	Demonstration of HYV LRG41
3	Literature distributed		1 leaflet (200 Copies)	Distributed leaflets developed on Red gram production technology during training and field days.

Table 3. Economics of Demonstration and Control Plots

	Yield q/ha	% increase in yield over local check	Cost of cultivation per ha. (Rs)	% decrease in cost of cultivation over local check	Net returns (Rs)	% increase in net returns over local check	CB ratio
Demonstration	18.75	26.67	11250	30.77	65625	38.86	1:3.7
Control	13.75		16250		40125		1:2.5

Table 4. Effect of Front Line Demonstrations on adoption of critical interventions

Recommended technology	Before				After			
	Adopted		Not adopted		Adopted		Not adopted	
	No.	%	No.	%	No.	%	No.	%
Recommended variety	39	43.33	51	56.67	73	81.11	17	18.88
Seed treatment	8	8.89	82	91.11	69	76.67	21	23.33
Timely fertilizers	22	24.44	68	75.56	58	64.44	32	35.56
Using neem oil	0	0.00	100	100.00	55	61.11	35	38.89
Need based pesticide use	14	15.56	76	84.44	61	67.78	29	32.22

Table 5. Production Constraints encountered by Redgram Farmers

S.No	Constraint	Frequency	Per cent
1.	Flower drop due to continuous dry spells	79	87.77
2.	Poor seed quality supplied by Govt. agencies	76	84.44
3.	Severe incidence of *Maruca*, Spodoptera and pod fly	72	80.00
4.	Increased cost of fertilizers and pesticides	66	73.33
5.	Severe wilt problem	53	58.88
6.	Non availability of drought tolerant varieties	46	51.11

Details of the extension activities organized

Two training programmes and two field days at critical stages of crop growth *viz.,* one at vegetative phase and another at flowering stages of the redgram were organized to enhance the knowledge levels of the farmers and showcase the results of the demonstration. Leaflets on redgram production technology were distributed to the farmers participated in training programmes and field days.

Economics of Demonstration and control plots

The results of the demonstrations in terms of productivity, cost of cultivation, net returns and CB ratios were presented in Table 3. It is evident from the results that there was an average productivity enhancement of 26.67 per cent in demo plots over control. With respect to cost of cultivation 30.77 per cent decrease was recorded over control plots. There was an average increase of 38.86 per cent in terms of net returns in

FLD plots over control. The CB ratio was 1:3.7 in demo units where as it was 1:2.5 in control plots. The major reasons for productivity enhancement were using High yielding Variety and using recommended dose of fertilizer as basal. Regarding the decreased cost of cultivation seed treatment, prophylactic neem oil spray and need based pest and disease management were the major factors contributed. The results were in conformity with Tripati *et al.*(2015).

Effect of Front Line Demonstrations on adoption of critical interventions

From Table 4 it could be inferred that there was a considerable variation in adoption of critical interventions demonstrated before and after organizing FLDs. Regarding adoption of High Yielding Variety almost sixty (56.67%) per cent of the farmers were not adopting previously, but eighty one per cent of them switched over to LRG 41 variety after organizing FLDs. This is because of the confidence gain in terms of yield potential of the variety among the farmers. Seed treatment was the another aspect where very meager per cent (8.89%) of the farmers were adopting previously, but with the positive result in terms of tolerance to wilt disease more than three fourth (76.67%) were adopting seed treatment after conducting demonstrations. As Redgram was cultivated in red soils under rainfed situation majority (75.56%) of the farmers were not interested in timely fertilizer management but after noticing the yield enhancement more than sixty per cent (64.44%) of the farmers were convinced and adopting recommended fertilizer at right time. Cent per cent of the farmers were not using neem oil spray as prophylactic against Maruka previously but after observing its effectiveness in demonstrations more than sixty per cent (61.11%) of the farmers were spraying neem oil at bud initiation and flowering stages. Great majority of the farmers (84.44%) were going for indiscriminate sprayings previously but 67.78 per cent of them were convinced with need based pest and disease management and reduced unnecessary sprays which ultimately led to reduced cost of cultivation.

Production Constraints encountered by Redgram Farmers

It is evident from the Table 5 that majority of the farmers expressed that flower drop due continuous dry spells (87.77%), poor quality seed supplied by Govt. agencies (84.44%), severe incidence of *Maruca* and pod fly (80.00%), increased cost of fertilizers and pesticides (73.33%), severe wilt problem (58.88%) and non availability of drought tolerant varieties (51.11%) were the major constraints in redgram production. Similar constraints were reported by Singh *et al.*(2007)

The critical interventions demonstrated were found to be the main reason for increase in the yield of redgram and thus it can be said that FLDs were the most successful tools for transfer of technology. The concept of front line demonstration may be used to all farmers for speedy and wider dissemination of the technology. It could be concluded that Front Line Demonstration (FLDs) have good potential to disseminate recommended technologies to the farming community.

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EFFECT OF PRO-POOR INITIATIVES FOR EMPOWERMENT OF RURAL WOMEN

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ABSTRACT

Women in rural areas are more vulnerable than urban in health related initiatives which are related to knowledge and awareness. *Health Initiatives* is willingness within the people to help themselves through self-help to collectively think, discuss and act on issues related to health. The South Asia Poverty Alleviation Programme (SAPAP) was implemented by the United Nations Development Programme (UNDP) in the form of pilot projects in six countries in South Asia. Its objective was to demonstrate to governments in the region the feasibility of using the approach of social mobilization to combat rural poverty. The present study conducted in the piloted South Asia Poverty Alleviation Programme (SAPAP) implemented by Government, in three drought–prone disticts *viz*.Mahaboobnagar, Kurnool, and Ananthapur. The approach and strategy of health initiatives followed was in consonance and congruence with broader conceptual framework of the main poverty alleviation programme, which was based on the premise and conviction that 'willingness within the people to help themselves' by developing community based health initiatives in which the community fully participated and was involved at every stage. The data was collected from 180 women SHG beneficiaries of 60 SHGs from 12 villages, to know their perception levels on Health Initiatives. The study concludes that rural women of SAPAP had both positive and negative relationships with health initiatives and socio economic factors.

Health is now higher on the international agenda than ever before, and concern for the health of poor people is becoming a central issue in development.The three of the Millennium Development Goals (MDGs) call for health improvements by 2015 reducing child deaths, maternal mortality, and the spread of HIV/AIDS, malaria and tuberculosis. The Post 2015 Development Agenda (successor to the Millennium Development Goals), aim for Sustainable Developmental Goals (SDG) popularly known as The 'Future We Want' by 2030. Beyond its intrinsic value to individuals, health is also central to overall human development and to the reduction of poverty (WHO 2003).

Women's participation in Self Help Groups (SHGs) have obviously created tremendous impact upon the life pattern and style of poor women and have empowered them at various levels not only as individuals but also as members of the family, members of the community and the society as whole. Health initiatives initiated in SAPAP project is 'willingness within the people to help themselves through Self-Help Groups (SHGs), to collectively think, discuss and act on issues related to health'.

The present study was conducted in the piloted South Asia Poverty Alleviation Programme (SAPAP) implemented by Government, in three drought–prone districts *viz* . Mahaboobnagar, Kurnool, and Ananthapur, with the support of United Nations Development Programme (UNDP).

MATERIAL AND METHODS

Research Design : Ex-post facto research design was used for conducting the study.

Sampling procedure : Multi-stage random sampling method was used for selecting the sample. The data was collected from 180 women SHG beneficiaries of 60 SHGs from 12 villages, to know their perception levels on Health Initiatives (Table 1).

Selection of the sample : Women from SAPAP (n=180) were randomly selected to know their perception levels on health initiatives.

Statistical Analysis: Frequency, percentage, standard deviation (SD), Pearson correlation and Z test were used for the statistical analysis.

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Table 1. Details of the Study Sample Undertaken among the SAPAP Beneficiaries

S. No.	District Selected	Mandals Selected	Villages Selected	No. of SHGs	No. of Respondents
1	Anantapur	Bukkaraya Samudhram	Rotarypuram	5	15
			Siddarampuram	5	15
		Pedda vaduguru	Virupapuram	5	15
			Liksmipalle	5	15
2	Kurnool	Oravakal	Loddipalle	5	15
			Nannur	5	15
		Gadivemula	Gadivemula	5	15
			Chinndukuru	5	15
3	Mahaboobnagar	Bommaraspeta	Bommaraspeta	5	15
			Metlakunta	5	15
		Kosgi	Bijjaram	5	15
			Mirjapur	5	15

Health Initiatives:

Content analysis

A set of items related to the health initiatives has been collected and edited from the entire universe of UNDPs SAPAP and other developmental programmes. Based on the consultations with experts and field level functionarries of SAPAP project, the statements were appropriately modified and rewritten. Finally 18 statements (Table 3) which represented the Health Initiatives related to various activities of the poverty and womens empowerment were selected and presented.

Selected items were administered to the rural women beneficiaries on a three point continuum of frequency adherence to the health initiatives i.e. '*Agree','undecided'* and '*disagree*' with the weightages of 3, 2 and 1 respectively and with a reverse order of 1, 2, and 3 for the negative statements.The average or mean score for each beneficiary was obtained through the responses of its respondents with positive and negative statements. The responses were classified (Table 2) into three categories based on their mean and SD as follows.

Table 2. Health Intiatives – Category of Repondents Response

Category	Score
Low	< Mean –SD
Medium	Mean± SD
High	>Mean +SD

Content analysis was carried out for all the 18 statements which constituted **Health Initiative** indicators as **Health initiative Index** and taken as a pro poor initiative for measuring empowerment of rural women beneficiaries.

$$\text{Health initiative Index} = \frac{\text{The obtained Health Initiatives score of the respondent}}{\text{Maximum possible Health initiatives scores}} \times 100$$

The obtained index score was used for calculating the empowerment of rural women through **Community Health Initiatives as the pro poor initiatives** (Table 3).

RESULTS AND DISCUSSION

The South Asia Poverty Alleviation Programme (SAPAP) was implemented by the United Nations Development Programme (UNDP) in the form of pilot projects in seven countries (Bangladesh, India, Maldives, Nepal, Pakistan, Bhutan and Srilanka) of South Asia Association of Regional Cooperation (SAARC) in South Asia. Its objective was to demonstrate to governments in the region, the feasibility of using the approach of social mobilization to combat rural poverty (Murthy *et al.* 2002).

Health Initiatives- the operational definition is 'willingness within the people to help themselves through self-help, to collectively think, discuss and act on issues related to health'. The results of the Index developed for the study of **Health Initiatves** by the SAPAP beneficiaries indicated (Table 3) that, majority of the beneficiaries (98.33%) agreed that 'Health check up', 'Immunisation' and 'Care during pregnancy', was taken care and importance was given for this only after joining the SHG group. Almost cent percent members (99.44) agreed that 'Deliveries were conducted by trained Dayi at home or by Professional Health Worker at the hospital'. Majority of the beneficiaries 96 percent agreed and accepted that 'Personal hygiene and sanitation measures' were improved after capacity building and awareness pogrammes of SAPAP's Health initiative. The 96 percent (95.56) SAPAP beneficiaries further agreed that 'Children below 5 years' were immunized regularly in the group. Majority of the members (92.22%), realized the need for 'Banning child marriages through awareness programmes' and agreed to prohibit the practice. They agreed that, they have campaigned strongly against 'dedicating girl child as *Jogini* or *Mathangi* (83.89%). Majority of (86.67 percent) the beneficiaries agreed that they 'Accept and follow family planning measures' and able to get health facilities and services through group pressure (79.44%). The results indicate that a very strong positive empowerment impact was induced on rural women of SHGs through **Health Initiatives** as a pro poor initiative attained through SAPAP.

Table 3. Content Analysis of Health Initiatives

S.No.	Health Initiatives	Disagree (DA)		Undecided (UD)		Agree (A)	
		F	%	F	%	F	%
1.	Health check up, immunisation and care during pregnancy, was taken after joining the groups	-	-	3	1.67	177	98.33
2.	Deliveries were conducted by trained Dayi at home or professional health worker at the hospital	-	-	1	0.56	179	99.44
3.	Children below 5 years were immunized regularly in the group	-	-	8	4.44	172	95.56
4.	Aware of health facilities and services provided by the government	17	9.44	50	27.78	113	62.78
5.	Knows about nutritious diet.	22	12.22	41	22.78	117	65.00
6.	Accept and follow family planning measures.	-	-	17	9.44	156	86.67
7.	Realized the need for banning child marriages through awareness programmes.	-	-	13	7.22	166	92.22
8.	Able to get health facilities and services through group pressure.	2	1.11	35	19.44	143	79.44

S.No.	Health Initiatives	Disagree (DA)		Undecided (UD)		Agree (A)	
		F	%	F	%	F	%
9.	Campaigned strongly against dedicating girl child as jogini or Mathangi	-	-	29	16.11	151	83.89
10.	Protested strongly against the female infanticide or foeticide	4	2.22	81	45.00	95	52.78
11.	Girl child is burden to the family and to the society.	157	87.22	23	12.78	-	-
12.	Safe water supply ensures good health	69	38.33	15	8.33	96	53.33
13.	Diarrhoea can be dangerous and lead to dehydration in children and hence treatment should not be delayed.	72	40	20	11.11	88	48.89
14.	Here is increase in infant/child deaths among the group members after group formation activity.	148	82.22	32	17.78	-	-
15.	Domestic violence was on increase after joining the group.	116	64.44	33	18.33	31	17.22
16.	Maternal mortality reduced among women because of regular health checkups and nutritional diet during pregnancy	22	12.22	34	18.89	124	68.89
17.	Personal hygiene and sanitation measures were improved	-	-	7	3.89	173	96.11
18.	Local priest is better than qualified medical practitioner for children health problem	159	88.33	21	11.67	-	-

Interestingly only half of the respondents (52.78%) protested against 'female infanticide', indicating that there is still a strong base for the traditional beliefs in the minds of these people prefering male child. Fifty percent of the respondents were aware of the importance of safe drinking water and the dangers of water borne diseases like diarrho ea, which can cause severe dehydration and death, particularly among the children ('Safe water supply ensures good health') . They were also aware of the oral rehydration methods. There is a drastic reduction in the infant mortality rate among the members of the SHGs after joining the group. The initial bias against children and pregnant women for their nutritional intake and early age marriage of girls are the two principal factors contributing to the high rates of mortality and low weight of the newborn babies. The maternal and infant mortality levels in Andhra Pradesh and Telangana are not commensurate to the overall economic development of the state which is real concern and has to be stressed upon.

Improved health knowledge of the focal group SHG members *viz.,* pregnant women, mothers of children below 5 years age, adolescent girls who were the target beneficaries of SAPAP benefited by these Health Initiatives. There is a perceptible change that has occurred in relation to' sanitation and hygiene' among the SHG members and in the family has been evident due to the health initiatives and there is decline in health expenditure thereby empowering the women and make them overcome their poverty.

Poverty and Health seeking behaviour of women was changed due to interventions of SAPAP, which was strongly felt by majority (88.33%). The institutional deliveries were increased and there is reduction in approaching the local quacks but going to the registered medical practitioners. The women members were also trained in best health practices inturn to teach the communities on health and sanitation. Many women used borrowed loan money for health

care and for the food consumption. This may be due to **health initiatives**, campaigns and awareness created by SAPAP.

Priya Sugandhi and Uma Maheswari (2016) also analyzed the awareness and effect of socio-economic factors of Indian elderly about functional foods, their benefits and influence of motivation on consumption of those foods and reported that 82% of elderly people were unaware of the functional foods such as probiotic yoghurt. Age, gender, education showed significant difference in consumption of yoghurt and motivation was required for continuous consumption of health beneficial foods which effect their perception and the rate of consumption of yoghurts. Tao *et al.* 2011 evaluated the attitudes and perceptions towards hormone therapy (HT) use, as well as specific concerns and information sources on HT since the Women's Health Initiative (WHI) randomized trial and negative factors reported included concerns about potential harmful effects, particularly cancer risks.

Giardana *et al*. (2011) focused knowledge and awareness among women with cardiometabolic risk factors based on women's health initiative to improve women's heart health and reported fewer participants with metabolic syndrome (MS) (62.6%) knew the leading cause of death compared to those without MS (72.1%) (p<0.0001).

Asobayire and Barley (2014) investigated influence of societal perceptions and attitudes on women's awareness of breast cancer in Ghana through focus group interviews and documentary analysis and concluded that women's perceptions and attitudes about breast cancer were influenced by a myriad of economic and socio-cultural factors such as absence of biomedical terminology in the local language, gender inequality and the prevailing influence of traditional health practitioners further compound the situation.

CONCLUSION

Health initiatives are important goals for the millennium development goals (2015) and SDGs (Sustainable Developmental Goals) which are targeted to 2030. It is also necessary for the rural women to get the knowledge and awareness about health initiative programmes. Women of SAPAP group have positive relationship with their socio-economic factors and health initiatives based on the statements and questions raised.

A pro-poor health approach gives priority to promoting, protecting and improving the health of poor people. It includes the provision of quality services in public health and personal care, with equitable financing mechanisms to improve health and prevent the spiral from ill health to poverty. Development agencies should help partner countries develop pro-poor health systems by strengthening local capacity in several areas.Pro poor inititiatives has helped Self Help Groups (SHGs) women by creating impact on their lives to improve their health on various aspects. This approach can be adopted by the governments and the development agencies as it has positive impact on women.This will go a long way as, 'if a woman ignited- her family,her village,her state,her country and the whole world is ignited'.

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SOCIO-ECONOMIC PROFILE OF DAIRY FARMERS IN DIFFERENT PRODUCTION SYSTEMS OF TELANGANA

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ABSTRACT

An investigation was carried out to study the socio-economic profile of dairy farmers of urban and peri urban production systems in and around Hyderabad city of Telangana. A total of 100 dairy farmers from both the production systems were selected by using simple random sampling technique for the study. A pre tested structured interview schedule was used to collect the data through personal interview. The information collected through interview schedule was analysed through suitable statistical tools. The findings of the socio-economic profile of the study revealed that majority of urban dairy farmers (82.0%) and peri urban dairy farmers (51.39%) lived in nuclear family and had medium annual income (84.0 and 60.0 %respectively), Most of the people participating in dairying belonged to backward community with an average age of 45.03 years. Majority had medium dairy farming experience. In urban areas majority of the dairy farmers were landless whereas in periurban areas majority were small farmers but dairying was the main occupation of farmers of both areas.There was a significant difference ($P<0.01$) between area under fodder crops, occupation and production systems.

Dairying is an occupation that supports the livelihood of majority of people in India. Apart from ensuring nutrient supplies to the families owning dairy farms, it also offers promising employment opportunities and handsome economic returns. Dairy farming is the key venture for the farmers of peri-urban areas. Dairy sector is also the major source of income for an estimated 27.6 million people. Cattle and Buffalo have a complementary, supplementary and sustainable relationship with crops in the mixed farming system. India has emerged as the world's largest milk producer and milk production continues to grow at a fairly high rate. India ranks first in milk production, accounting for 18.5 % of world production. Dairying has taken a new turn by venturing itself on commercial basis leading to the growth of milk-production activities in and around urban and peri urban areas.

Currently, a number of smallholder and commercial dairy farms are emerging mainly in the urban and peri-urban areas and most towns and districts. Smallholder rural dairy farms are also increasing in number in areas where there is market access. Continuous monitoring of information on socio-economic status of farmers like family type, literacy, caste, age etc is essential to formulate the future polices for improvement of dairy farming. Hence, an attempt was made to study the socio-economic profile of dairy farmers in urban and periurban production systems in and around Hyderabad city of Telangana.

MATERIAL AND METHODS

The study area was divided into urban and peri urban areas. From Urban area, five mandals namely Asifnagar, Bahadurpura, Charminar, Golconda, Khairtabad and from periurban area Hayathnagar, Nagole, Ramachandrapuram, Kothur and Bhongir were selected purposively for the present study. From each mandal, ten dairy farmers were selected by simple random sampling method, thus a total of hundred dairy farmers were selected for the study covering urban and peri urban areas of Hyderabad.

Based on identified variables preliminary interview schedule was developed and administered in the non sample area for pre testing. The pre tested interview schedule was used to collect primary data from the respondents through personal contact. While collecting the data sufficient time was given to the farmer to arrive at values by memory recall method. Information on various socio economic profile like type of family, literacy level, age, caste, experience in dairy farming, annual income, land holding, area under fodder crops, occupation were recorded.

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The data, thus collected during the period of study was scrutinized and tabulated into frequency, percentages, arithmetic mean, standard error and analysis of variance following the methods suggested by Snedecor and Cochran (1994) while the significant differences between parameters and frequencies were analyzed by Chi-square test using SPSS, version 22.0.1 (Statistical Package for Social Sciences).The information obtained was analyzed and interpreted.

RESULTS AND DISCUSSION

The different socio-economic profile of the dairy farmers is presented in the Table 1.

Table 1. Socio- economic profile of Dairy farmers of different production systems

S.No	Particulars	Category	Urban (N=50)		Periurban (N=50)		Mean	S.D	Chi-square value
			Frequ-ency	Per-cent	Frequ-ency	Per-cent			
1.	Family type	Nuclear	41	82	43	86	-	-	0.298^{NS}
		Joint	9	18	7	14			
2.	Literacy level	Illiterate	0	0	1	2	-	-	5.555^{NS}
		Primary	5	10	8	16			
		Upper primary	14	28	13	26			
		High school	23	46	14	28			
		College	8	16	14	28			
3.	Caste	Scheduled caste	0	0	5	10	-	-	17.554^{NS}
		Schedule tribe	1	2	1	2			
		Backward caste	42	84	23	46			
		Other caste	7	14	21	42			
4.	Age	Young	15	30	10	20	45.03	10.078	2.017^{NS}
		Middle	29	58	30	60			
		Old	6	12	10	20			
5.	Experience in dairy farming	Low	14	28	10	20	16.79	6.415	2.350^{NS}
		Medium	31	62	30	60			
		High	5	10	10	20			
6.	Annual income	Low	5	10	8	16	337370	198520	8.092*
		Medium	42	84	30	60			
		High	3	6	12	24			
7.	Land holding	Land less	49	98	3	6	-	-	84.942^{NS}
		Marginal	0	0	16	32			
		Small	0	0	16	32			
		Large	1	2	15	30			

S.No	Particulars	Category	Urban (N=50)		Periurban (N=50)		Mean	S.D	Chi square value
			Frequ-ency	Per-cent	Frequ-ency	Per-cent			
8.	Area under fodder crops	Less than 0.5 acres	0	0	25	50	-	-	62.455**
		0.5 and above	1	2	17	34			
		No fodder crops	49	98	8	16			
9.	Occupation	Agriculture	0	0	17	34	-	-	23.349**
		Dairying	34	68	27	54			
		Others	16	32	6	12			

**Significant at 5 per cent level; **Significant at 1 per cent level; NS- Non-significant;*

The typical Indian joint family system disintegrated over period and now nuclear families are more predominant. Even in the present study, it has been found that majority (82.0 and 86.0%) of dairy farmers in both production systems had nuclear families followed by joint families. (18.0 and 14.0%).The findings were similar to the result of Mande *et al.* (2009) who observed that 63.33 per cent of the dairy farmers were nuclear type of family and 36.67 per cent were joint type of family in his study at Lathur district of Maharashtra.

Education plays a key role in adoption of improved management practices in livelihood enterprises**.** It was noticed that 46.0, 28.0, 16.0 and 10.0 per cent of urban farmers had high school, upper primary, college and primary level education, respectively. About 28.0 per cent of dairy farmers had studied up to high school and college level followed by upper primary (26.0%), primary (16.0%) level in peri urban areas. Only 2.0 per cent of dairy farmers were illiterate in peri urban areas while no illiterate was found in urban area. The better literacy in the urban area might be due to better basic educational infrastructure. The results in general indicated that dairy farmers in the study area are mainly literate; suggesting that with good extension and training program they can improve their dairy production and marketing. The present results were in agreement with the findings of Ahirwar *et al.* (2010) who reported that majority of urban farmers had education up to metric level in Indore district of Madhya Pradesh and Soysal *et al*. (2005) in his study indicated that only 7.0 per cent of farmers had never taken any education.

Majority (65.0%) of dairy farm owners belonged to backward caste in urban and peri urban areas followed by other caste (28.0%). It indicated that backward caste and other caste group were actively involved in dairying as a source of income and employment for their livelihood. This result was in conformity with the findings of Manivannan *et al*. (2009) and Ahirwar *et al.* (2010) who reported that the majority of the dairy farmers belonged to backward community and other caste, respectively in their studies.

Majority of dairy farmers (59.0 %) were in the middle age category followed by young (25.0%) and old age (16.0%) in urban and peri urban production systems. It was obvious that middle aged were considered to be mature for undertaking innovations by virtue of their adequate experience. Further, this could be middle and young aged dairy farmers are more eager, interested and enthusiastic to earn additional income from dairy management there by improve the livelihood status. This result was similar to the findings reported by Debasish *et al.* (2010), Dhaka *et al.* (2011), Rathod *et al.* (2011) and Gami *et al.* (2013).

Majority (61.0%) of dairy farmers in both production systems had medium experience followed by low (24.0%) and high (16.0%) experience in dairy farming with an average experience of 16.79 years. Experience of dairy farmers is interrelated with technologies adoption. On contrary Quddus (2012)

reported that 66.0% of respondents had less than 10 years of dairy farming experience in different agro climatic condition in Bangladesh.

From the table (1) it was found that 84.0 and 60.0 percent of dairy farmers had medium annual income followed by low (10.0 and 16.0%), respectively in urban and peri urban areas with an average income of Rs. 3, 37,370/-. Significant (P<0.05) association was noticed between mean household income and production systems. The probable reasons could be more number of livelihood sources for farmers like dairying plus work in cities. This result was similar to the findings as reported by Manivannan *et al.* (2009) who stated that majority (62.0%) of dairy farmers belonged to medium annual income group.

In urban area majority (98.0%) of dairy farmers belonged to landless category whereas in peri urban areas majority (32.0%) of dairy farm owners were small and marginal farmers, followed by large and landless category. From this study it could be inferred that dairying was considered as a source of income and employment to family members of all categories. Significant (P<0.01) association was observed between mean land holding and production systems. The reason for possession of land in small size might be the regular fragmentation of land occurring in the peri-urban areas between children when the families get separated. This finding was in agreement with the result of Vij and Tantia (2005) who reported that majority of buffalo farmers were land less, marginal and small farmers. Whereas Ahirwar *et al.* (2010) revealed that majority of dairy farmers were landless in urban area. In contrast to the present findings Kishore *et al.* (2013) stated that majority of the dairy farmers were marginal and large farmers in the study area.

Further, present study revealed that 50.0 per cent of dairy farmers cultivated fodder crops in an area of less than 0.5 acres in peri urban system, whereas only 2.0 and 34.0 per cent of dairy farmers cultivated fodder crops in an area above 0.5 acres in urban and peri urban sytems, respectively**.** About 98.0 and 16.0 per cent of dairy farmers did not cultivate fodder crops in urban and peri urban systems, respectively. Significant (P<0.05) association was observed between area under fodder crops and production systems.This might be due to fragmentation of land and whatever the land available with farmers that might be used for cultivating the commercial crops in the study area. This finding was in agreement with the result of Kishore *et al.* (2013) and Shegokar *et al*. (2014) who reported that the majority of dairy farmers were not raising fodder crops in their study area.

Though dairy farming was an important economic activity, dairy farmers were also engaged in agriculture and other activities. In urban production system majority (68.0%) of dairy farmers considered dairying as main occupation followed by other business (32.0%) while in periurban production system 54.0 per cent considered dairying as major occupation followed by agriculture (34.0%) and other business (12.0%). Significant (P<0.01) association was observed between occupation and production system. It might be due to the fact that there is huge demand for milk in and around Hyderabad city and also farmers are getting good price from sale of milk and also a persistent source of income. These results were similar to Prasad *et al.* (2001) who reported dairying was the main occupation for 64 per cent of milk producers in and around Hyderabad city.

CONCLUSION

It is concluded that majority of the dairy farmers have nuclear families, literates, belonged to backward caste, middle aged with medium income. If proper technical guidance regarding dairy farming from scientists and financial support from government is provided, it will make a positive impact on the farmers to improve knowledge and skills thereby uplifting their socio economic status.

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Research note
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GROWTH AND DRY MATTER PRODUCTION ON YIELD OF RICE (*Oryza sativa* L.) VARIETIES UNDER ALTERNATE WETTING AND DRYING IN PUDDLED SOIL

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Food security in Asia is challenged by increasing food demand and threatened water availability. Geometric growth of population and arithmetic increase in food grain production leave a vast gap in food supply. In India and Telangana, rice occupies an area of 44.10 M ha and 14.15 lakh ha, respectively during 2014-2015 (DoES, 2015). As per the concepts of water foot print and virtual water to produce one kg of rice 3000-5000 liters of water is required. Being a water-intensive crop, cultivation of paddy has been a big drain on water resources. Rice is a heavy water consumer but water for rice production is becoming scarce and expensive due to the increased demand for water from the ever growing population and industries (Chowdhury *et al*. 2014). Irrigated lowland rice not only consumes more water but also causes wastage of water resulting in degradation of land. In recent years to tackle this problem, many methods of cultivation have been developed. Among the different methods of water-saving irrigation, the most widely adopted is Alternate Wetting and Drying (AWD) irrigation method (Li and Barker, 2004).

A field experiment was conducted on sandy clay soil at Agricultural College farm, Rajendranagar, Hyderabad during *kharif,* 2016 in a split plot design with three replications**.** The treatments comprised of three irrigation regimes (AWD irrigation of 5 cm when water level falls below 5 cm from soil surface in field water tube, AWD irrigation of 5 cm, at one day after disappearance of water on the surface of the soil and recommended submergence of 2-5 cm water level as per crop stage) as main plot treatments and four rice varieties (Telangana sona, Kunnaram sannalu, Bathukamma and Sheethal) as sub plots treatments. The seedlings of different rice varieties at 21days age were transplanted by adopting a spacing of 15 × 15 cm. The recommended dose of 120:60:40 N, P_2O_5 and K_2O kg ha^{-1} was applied. The experimental soil was sandy clay in texture, moderately alkaline in reaction, non-saline, low in organic carbon content, low in available nitrogen (N), medium in available phosphorous (P_2O_5) and potassium (K_2O). The data generated was statistically analysed by adopting standard methods.

Results of the experiment indicated that the plant height was not significantly influenced by irrigation regimes and interaction between varieties and irrigation. Among varieties, Sheethal recorded significantly higher mean plant height (67.1, 102.7, 122.4 and 122.8 cm) than Bathukamma (51.0, 77.5, 96.7 and 97.0 cm), Kunaram Sannalu (50.0, 80.5, 101.1 and 101.5 cm) and Telangana Sona (45.5, 72.7, 91.7 and 92.1 cm) at different growth stages of crop (30, 60, 90 DAT and harvest). However, Bathukamma and Kunaram Sannalu were at par with each other. Significantly lower plant height was recorded with Telangana Sona at different growth stages of crop (30, 60, 90 DAT and harvest) (Table 1). The variation in plant height may be due to genetically inherent character of these varieties.

Number of tillers $hill^{-1}$ at various crop growth sub-periods of rice was significantly influenced by different rice varieties and irrigation regimes except at 30 DAT (Table 2). Among the different irrigation regimes, the number of tillers $hill^{-1}$ did not differ significantly at different stages except at 90 DAT and harvest. Recommended submergence of 2-5 cm water level as per crop stage (I_3) recorded significantly higher average number of tillers $hill^{-1}$ (16.9 and 13.7) than AWDI of 5 cm irrigation when water level falls 5 cm (I_1) below in the field water tube (15.6 and 12.0) and was on par with AWDI of 5 cm one day after

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disappearance (I_2) of ponded water (16.0 and 13.0) at 90 DAT and harvest. Significantly lower average number of tillers hill^{-1} was obtained with AWDI of 5 cm submergence when water level falls 5 cm below in the field water tube (I_1) (12.0). However, AWDI of 5 cm irrigation when water level falls 5 cm below in the field water tube (I_1) and AWDI of 5 cm one day after disappearance of ponded water (I_2) were at par with each other. Lower number of tillers under delayed irrigation could be due to development of water stress in plants which resulted in reduced cellular growth and lower leaf water potential (Begg and Turner, 1976). Frequent irrigations and maintenance of 2-5 cm submergence created favourable moisture regimes enabled the crop to grow lavishly by providing conductive micro climate and increase absorption, translocation and assimilation of nutrients by the plant for various physiological process (Dass and Chandra, 2012) and in turn helped the plants to boost their growth through supply of more photosynthates towards reproductive sinks which caused to produce more number of tillers plant^{-1}. Similar results were reported by Pandey *et al*. (2010) and Kumar *et al*. (2014).

Among the varieties, Telangana Sona recorded higher average number of tillers hill^{-1} at different growth stages of crop than rest of the varieties (Table 2). At 60 DAT, average number of tillers hill^{-1} were significantly higher in Telangana Sona (12.3) than Bathukamma (11.4) and was on par with Kunaram Sannalu (12.0) and Sheethal (11.6). Telangana Sona recorded significantly higher average number of tillers hill^{-1} (17.0) than Kunaram Sannalu (15.9), Bathukamma (15.9) and Sheethal (15.9) at 90 DAT. At harvest, Telangana Sona recorded significantly higher average number of tillers hill^{-1} (13.5) than Bathukamma (12.6) and Sheethal (12.3) and was on par with Kunaram Sannalu (13.0), though number of tillers hill^{-1} of Kunaram Sannalu, Bathukamma and Sheethal were at par at 90 DAT and harvest. Significantly lower number of tillers hill^{-1} was recorded with Sheethal than rest of the varieties. The variation in number of tillers hill^{-1} among varieties was due to genetically inherent character of the varieties.

Dry matter production (kg m^{-2}) at various crop growth sub-periods of rice was significantly influenced by differed irrigation regimes except at 30 DAT (Table 3) and among the different irrigation regimes, recommended submergence of 2-5 cm water level as per crop stage (I_3) recorded significantly higher dry matter production (0.88 kg m^{-2}) than AWDI of 5 cm irrigation when water level falls 5 cm below in the field water tube (I_1) and was on par with AWDI of 5 cm one day after disappearance of ponded water (I_2). However lower dry matter production were obtained with AWDI of 5 cm submergence water level falls 5 cm below in the field water tube (I_1, 0.79 kg m^{-2}) and was on par with the AWDI of 5 cm one day after disappearance of ponded water (I_2, 0.83 kg m^{-2}) at 60 DAT. Significantly higher dry matter production (1.38 and 1.50 kg m^{-2}) registered under recommended submergence of 2-5 cm water level as per crop stage (I_3) than AWDI of 5 cm at one day after disappearance of ponded water (I_2, 1.26 and 1.35 kg m^{-2} respectively) and AWDI of 5 cm irrigation when water level falls 5 cm below in the field water tube (I_1) at 90 DAT and harvest. Significantly lower drymatter was obtained with AWDI of 5 cm submergence water level falls 5 cm below in the field water tube (I_1, 1.08 and 1.18 kg m^{-2} respectively) at 90 DAT and harvest. In the present investigation, consequence of favorable growing environment, better uptake of nutrients helped the plants to boost their growth leading to produce more tillers (Table 2) and pronounced plant height (Table1) through supply of more photosynthates towards sink lead to production of higher dry matter under AWDI of 5cm one day after disappearance of ponded water and recommended submergence of 2-5 cm water level as per crop stage compared to AWDI of 5 cm submergence depth when 5 cm drop of water level in the field tube. Similar results of increased dry matter under AWDI of 5cm at one day after disappearance of ponded water and recommended submergence of 2-5 cm water level as per crop stage were reported Kumar *et al.*(2014) and Chowdhury *et al.* (2014).

Among the varieties, Bathukamma (0.26, 0.85 and 1.30 kg m^{-2} respectively), Kunaram Sannalu (0.26, 0.87 and 1.25 kg m^{-2} respectively) and Sheethal (0.28, 0.84 and 1.23 kg m^{-2} respectively) recorded on par dry matter production at 30, 60 and 90 DAT, and were significantly higher dry matter production than Telangana Sona. At 30 DAT Sheethal recorded significantly higher dry matter than Telangana Sona, though on par with other two varieties of Bathukamma and Kunaram Sannalu. Bathukamma recorded

significantly higher dry matter at 90 DAT than Telangana Sona and was on par with Kunaram Sannalu. At harvest, Bathukamma recorded significantly higher dry matter production (1.42 kg m^{-2}) than rest of the varieties *viz*., Kunaram Sannalu (1.35 kg m^{-2}), Sheethal (1.32 kg m^{-2}) and Telangana Sona (1.27 kg m^{-2}). Lower dry matter production was recorded with Telangana Sona at 30,60,90 DAT and harvest than other varieties and was significantly lower than all other varieties at 60 DAT, than Bathukamma at 90 DAT and harvest though on par with the same at 30 DAT. Telangana Sona was on par in dry matter production with Kunaram Sannalu at 30 DAT and 90 DAT and with Sheethal at 90 DAT and harvest. Variation in dry matter production among varieties and lower dry weight of Telangana Sona might be due to genetically inherent character of the varieties.

Based on the research results, it can be concluded that recommended submergence of 2-5 cm water level as per crop stage recorded higher dry matter, tillers $hill^{-1}$ followed by one day disappearance of ponded water. Among varieties sheethal recorded higher plant height, Telangana Sona was with higher tillers $hill^{-1}$ and Bathukamma produced higher dry matter production, grain yield and straw yield compared to Kunaram Sannalu, Sheethal and Telangana Sona.

Table 1. Plant height (cm) of rice varieties at different growth intervals as influenced by different irrigation regimes.

Treatment	30 DAT	60 DAT	90 DAT	At harvest
Main plot- (Irrigation regimes)				
I_1: AWDI of 5 cm, when water level falls below 5 cm from soil surface in perforated pipe	53.5	81.9	102.3	102.5
I_2: AWDI of 5 cm, one day after disappearance of ponded water on the surface of the soil	52.4	81.9	102.8	103.2
I_3: Recommended submergence of 2-5 cm water level as per crop stage.	54.3	86.4	103.9	104.4
SEm±	0.6	1.2	0.7	0.7
C.D (P=0.05)	NS	NS	NS	NS
Sub plot- (Varieties)				
V_1 – RNR 15048 (Telangana sona)	45.5	72.7	91.7	92.1
V_2– KNM 118 (Kunaram sannalu)	50.0	80.5	101.1	101.5
V_3– JGL 18047 (Bathukamma)	51.0	77.5	96.7	97.0
V_4– WGL 283 (Sheethal)	67.1	102.7	122.4	122.8
SEm±	1.1	1.4	0.7	0.7
C.D (P=0.05)	3.3	4.1	2.1	2.1
Interaction				
Rice varieties at same level of Irrigation regimes				
SEm±	1.9	2.4	1.2	1.2
C.D (P=0.05)	NS	NS	NS	NS
Irrigation regimes at same or different rice varieties				
SEm±	1.8	2.4	1.3	1.2
C.D (P=0.05)	NS	NS	NS	NS

DAT: Days After Transplanting, AWDI: Alternate Wetting and Drying Irrigation NS: Non Significant

Table 2. Number of tillers hill^{-1} of rice varieties at different growth intervals as influenced by different irrigation regimes

Treatment	30 DAT	60 DAT	90 DAT	At harvest
Main plot - (Irrigation regimes)				
I_1: AWDI of 5 cm, when water level falls below 5 cm from soil surface in perforated pipe.	6.3	11.6	15.6	12.0
I_2: AWDI of 5 cm, one day after disappearance of ponded water on the surface of the soil.	6.4	11.9	16.0	13.0
I_3: Recommended submergence of 2-5 cm water level as per crop stage.	6.3	11.9	16.9	13.7
SEm±	0.2	0.2	0.2	0.3
C.D (P=0.05)	NS	NS	1.0	1.2
Sub plot - (Varieties)				
V_1 – RNR 15048 (Telangana sona)	6.6	12.3	17.0	13.5
V_2– KNM 118 (Kunaram sannalu)	6.4	12.0	15.9	13.0
V_3– JGL 18047 (Bathukamma)	6.2	11.4	15.9	12.6
V_4– WGL 283 (Sheethal)	6.2	11.6	15.9	12.3
SEm±	0.3	0.2	0.3	0.2
C.D (P=0.05)	NS	0.7	0.8	0.7
Interaction				
Rice varieties at same level of Irrigation regimes				
SEm±	0.6	0.4	0.5	0.4
C.D (P=0.05)	NS	NS	NS	NS
Irrigation regimes at same or different rice varieties				
SEm±	0.6	0.4	0.5	0.4
C.D (P=0.05)	NS	NS	NS	NS

DAT: Days After Transplanting, AWDI: Alternate Wetting and Drying Irrigation NS: Non Significant

Table 3. Dry matter accumulation of rice varieties (kg m^{-2}) at different growth intervals as influenced by different irrigation regimes.

Treatment	30 DAT	60 DAT	90 DAT	At harvest
Main plot - (Irrigation regimes)				
I_1: AWDI of 5 cm, when water level falls below 5 cm from soil surface in perforated pipe.	0.25	0.79	1.08	1.18
I_2: AWDI of 5 cm, one day after disappearance of ponded water on the surface of the soil.	0.26	0.83	1.26	1.35
I_3: Recommended submergence of 2-5 cm water level as per crop stage.	0.27	0.88	1.38	1.50
SEm±	0.01	0.01	0.03	0.02
C.D (P=0.05)	NS	0.06	0.11	0.09

Treatment	30 DAT	60 DAT	90 DAT	At harvest
Sub plot- (Varieties)				
V_1 – RNR 15048 (Telangana sona)	0.23	0.78	1.17	1.27
V_2– KNM 118 (Kunaram sannalu)	0.26	0.87	1.25	1.35
V_3– JGL 18047 (Bathukamma)	0.26	0.85	1.30	1.42
V_4– WGL 283 (Sheethal)	0.28	0.84	1.23	1.32
SEm±	0.01	0.02	0.03	0.02
C.D (P=0.05)	0.03	0.05	0.08	0.05
Interaction				
Rice varieties at same level of Irrigation regimes				
SEm±	0.02	0.03	0.05	0.03
C.D (P=0.05)	NS	NS	NS	NS
Irrigation regimes at same or different rice varieties				
SEm±	0.02	0.03	0.05	0.03
C.D (P=0.05)	NS	NS	NS	NS

DAT: Days After Transplanting, AWDI: Alternate Wetting and Drying Irrigation NS: Non Significant

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Research note
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FARMER'S NEED ASSESSMENT FOR HYBRID PADDY AND FACTORS INFLUENCING THE PURCHASE DECISION

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Hybrid rice technology is likely to play a key role in increasing the rice production. During the year 2008, hybrid rice was planted in an area of 1.4 m.ha and an additional rice production of 1.5 to 2.5 m.t. (Directorate of Rice Research, 2014) was added to our food basket through this technology. More than 80 per cent of the total hybrid rice area is in Eastern Indian states like Uttar Pradesh, Jharkhand, Bihar, Chattisgarh, with some little area in states like Madhya Pradesh, Assam, Punjab and Haryana. As rice is a key source of livelihood in Eastern India, a considerable increase in yield through this technology will have a major impact on household food and nutritional security, income generation, besides an economic impact in the region. In view of this, hybrid rice has been identified as one of the components under the National Food Security Mission (NFSM) launched by the Government of India (GOI) with the aim to enhance rice production by 10 m.t. by 2011-12. Similarly, added emphasis is being given for adoption of hybrid rice under the special scheme of GOI to bring green revolution to Eastern India.

It is two decade now since the first hybrid was developed and released for commercial cultivation in India in 1994. During the first decade, adoption of hybrid rice has been much slower than expected, mainly because of lower grain quality and consequently lower market price for the produce. However, the yield advantage of hybrids in the range of 15-20 per cent over the high yielding inbred varieties has been well established in the farmers' field. The production of hybrid rice has increased because of increasing popularity and profitability of hybrid rice among the rice farmers of Eastern Uttar Pradesh, Bihar, Jharkhand and Chattisgarh. Large scale adoption of hybrid rice is expected in these states during next decades (Janaiah and Xie, 2008).

Hybrid rice is also picking up in Haryana and Punjab states in recent years. It is reported from these states that less fertilizers and water are needed for hybrid rice as compared to the high yielding varieties. The earliness of hybrids is also another advantage reported, facilitating timely sowing of wheat crop or creating possibility of growing short duration inter crops.

Keeping in view the importance of hybrid rice in India's food security system, the study on farmers need assessment and factors influencing their purchase decision was carried out in Uttar Pradesh.

Allahabad, Faizabad, Sultanpur, Gorakhpur and Jaunpur districts were identified for the study. Four tahsils were selected from each district and from each Tahsil, 6 villages were chosen for investigation. From each of the village, 8-10 farmers were randomly selected. Therefore, the entire study comprised of 5 districts, 20 tahsils, 96 villages and 630 farmers. The selection of the tahsils and villages was based upon the highest acreage under hybrid paddy. Garrett technique was used to identify the farmers need assessment factors.

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Table 1. Farmer's need assessment with regard to hybrid Paddy

S.No	Parameters	Mean score	Rank
1	Yield	82.84	I
2	Price	78.66	III
3	Pest & disease resistance	63.41	VIII
4	Easy Availability	59.12	IX
5	Quality	67.34	VII
6	Brand image	72.18	V
7	Govt. subsidy	70.10	VI
8	Extension services	74.31	IV
9	Crop duration	79.64	II

The farmers needs and expectations from hybrid paddy are presented in Table 1. About 14 parameters were identified and the farmers' were asked to prioritize based on their importance by allotting the ranks. Using Garrett ranking technique the scores were calculated. The analysis reveals that yield has been on the top most agenda by the farmers with regard to the expectations from hybrid paddy and therefore ranked as 1st with a mean score of 82.84. The 2nd important criteria is the crop duration with a mean score of 79.64. Farmers expect a shorter duration of hybrid paddy which would save on their costs and give higher profits. The 3rd criteria, farmers look for is the price (mean score 78.66) followed by extension services of the company ranked at 4th position with mean score of 74.31. The other needs of the farmers in the order of importance are brand image (5th rank), government subsidy (6th rank), quality (7th rank), pest and disease resistance (8th rank), and easy availability (9th rank). This analysis will help the companies to focus their efforts on the priorities of the farmers when they are bringing out any hybrid paddy brand into the market.

Table 2. Factors influencing farmers in selection of hybrid Paddy

S.No	Parameters	Mean score	Rank
1	Yield	82.84	I
2	Pest and disease	64.31	VII
3	Price	60.29	VIII
4	Govt subsidy	50.31	XIII
5	Extension services	73.28	V
6	Crop duration	78.38	III
7	Easy availability	58.33	IX
8	Agro climatic suitability	50.24	XIV
9	Germination %	57.28	X

Farmers are usually influenced by various parameters while selecting a paddy hybrid. The Table 2 shows the influencing factor on farmers purchase behaviour of a particular brand of hybrid seed. The analysis shows yield as the most influencing factor while selection of paddy hybrid and therefore placed at 1st rank with mean score of 82.84. Dealer's advice was considered as the 2nd important influencing factor with a mean score of 79.69. Since the duration of crop is considered very crucial by the farmers, it is ranked at 3rd position (mean score 78.38). As farmers are influenced by other fellow farmers advice while cultivating any crop Variety, therefore weightage to it gave it 4th position (mean score 74.62) followed by the extension services provided by the company and brand image being ranked at 5th and 6th position respectively. The other factors in the order of importance which influence the purchase decision are resistance to pest and disease (7th rank), price of the seed (8th rank), easy availability (9th rank), germination % (10th rank), taste (11th rank) and physical purity (12th rank). The government subsidy and agro climatic suitability are ranked at 13th and 14th rank respectively with mean score of 50.31 and 50.24. Thus the above analysis clearly indicates that yield and dealer's advice as the most crucial influencing factors in hybrid paddy seed selection

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INFLUENCE OF INTEGRATED WEED MANAGEMENT PRACTICES AND BIO-FERTILIZERS ON NODULATION OF *KHARIF* SOYBEAN [*Glycine max (L.) Merill*]

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Soybean [*Glycine max (L.) Merill]* occupies third place among oilseed crops of Telangana State and is a rich source of protein (40-42 %) and quality oil (20-22%). Presently about 90% of the area cultivated under soybean is treated with herbicides (Peer *et al*., 2013). The herbicides apprehend to have direct or indirect consequences on non-targeted organisms including soil micro flora in the field. Nodulation is a unique property of the legumes to fix atmospheric nitrogen and benefit the crop. Herbicide application in super optimal concentrations or applied continuously may accumulate in toxic concentrations. They pose a threat by damaging the number and weight of nodules. Niewiadomska (2004) also reported that the herbicides may directly affect the free living populations of nodular bacteria in the soil or indirectly influence the extent of infection and thus the number of nodules formed Jha *et al.* (2014). Singh (2007) also recorded significant improvement in number of nodules plant^{-1} by the combined application of *Rhizobium* and *Pseudomonas* with 5 t ha^{-1} FYM over the recommended dose of fertilizers.

A field experiment was conducted to study the influence of integrated weed management practices and biofertilizers on nodulation of *kharif* soybean [*Glycine max (L.)Merill]* at Agricultural College Farm, Rajendranagar, Hyderabad during 2014 and 2015 on sandy loam soil having 7.8 pH and EC 0.21 dS m^{-1} with nutrient status of 0.35% OC and 226,18 & 236 kg ha^{-1} available N P and K respectively, in split plot design.

The treatments comprising of pre-emergence application of pendimethalin @ 1.0 kg a.i ha^{-1} followed by hand weeding at 25 DAS, pre emergence application of pendimethalin @1.0 kg a.i ha^{-1} followed by post-emergence application of imazethapyr @ 100 g a.i ha^{-1}+ quizalofop-p-ethyl @ 50 g a.i ha^{-1} 25 DAS, pre–emergence application of pendimethalin @1.0 kg a.i ha^{-1} followed by post-emergence application of odyssey i.e. imazethapyr + imazamox @ 70 g a.i ha^{-1} at 25 DAS. Hand weeding at 25 and 45 DAS and un-weeded check as main treatments and sub plot treatments were recommended dose of fertilizers @ 30:60:40 kg ha^{-1} NPK, RDF + seed treatment with rhizobium @250g10kg^{-1}seed, RDF + seed treatment with rhizobium @ 250g 10kg^{-1} seed + phosphate solubilizing bacteria @ 5 kg ha^{-1}, RDF + seed treatment with rhizobium @ 250 g10 kg^{-1} seed + phosphate solubilizing bacteria @ 5 kg ha^{-1} + potassium solubilizing bacteria @ 5 kg ha^{-1}. Recommended fertilizer dose of NPK was applied at the time of sowing in the form of urea, single super phosphate and muriate of potash. The biofertilizers *Bradyrhizobium japonica* and phosphate solubilising bacteria were mixed as per the treatments in Jaggery solution prepared @ 250 g for 10 kg seed. The seed was thoroughly mixed with the solution and shade dried. The potassium solubilising bacteria were applied @ 5 kg ha^{-1} after mixing with FYM at the time of sowing the seeds. The seeds @ 63 kg ha^{-1} were dibbled at the rate of two hill^{-1} 10 cm apart in 30 cm rows. The crop was sown on 10th July in 2014 and 18th June in 2015. The plant samples uprooted for dry matter measurements were used for counting the nodules plant^{-1} on roots at 30, 60 DAS and at harvest. The roots were immersed in water to remove the soil. The functional nodules that turned pink and red were counted. The root nodules were separated from the roots and collected separately for 5 plants in each treatment. They were then oven-dried at 70 ºC for 72 hours and their dry weight was recorded. Statistical analysis was carried out as per standard procedures.

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The data obtained in the field experiment presented in table.1 indicated that the pre-emergence application of pendimethalin @ 1.0 kg *a.i* ha^{-1} also had similar effect to this trend, the number of nodules did not differ significantly even at harvest owing to the commencement of their degeneration. However, different nodulation pattern was clearly exhibited at 30 DAS. Maximum number of 25.95 and 27.18 nodules $plant^{-1}$ were recorded during 2014 and 2015 due to hand weeding. The pre-emergence application of pendimethalin @ 1.0 kg *a.i* ha^{-1} integrated with hand weeding at 25 DAS reduced the nodules to 24.00 during 2014 and to 26.85 number $plant^{-1}$ during 2015 compared to their elimination by hand weeding at 25 and 45 DAS. The pre and post emergence application of herbicides imazamox and quizalofop-p-ethyl in combination with Imazethapyr severely reduced the nodules compared even to the un-weeded check. Similar findings were observed by Bharti *et al*.(2014) that the post-emergence application of imazethapyr @ 75 or 100 g *a.i* ha^{-1} significantly reduced the number of nodules $plant^{-1}$ compared to hand weeding at 20 and 40 DAS. However, the herbicide was no toxic when mixed with 750 ml ha^{-1} sticker 'emulan'. On the other hand Angiras *et al.* (1995) reported that the pre plant incorporation, pre or early post emergence application of imazethapyr increased the number of nodules $plant^{-1}$ with increase in concentration from 50 to 200g *a.i* ha^{-1}. Deviating from these investigations, Jha *et al.* (2014) also reported that the number of nodules $plant^{-1}$ were on par by the post emergence application of imazeythapyr (10% SL) @ 100 g *a.i* ha^{-1} with the weed free treatment at 70 DAS. Root nodules were also on par with hand weeding treatment by the post emergence application of haloxyfop ethoxy ethyl @ 50,75 or 100 g *a.i* ha^{-1}.

There was significant difference between RDF and RDF+ Rhizobium in number of nodules at any stage over the response obtained due to fertilizer application during 2014 and 2015. The inoculation of *Rhizobium* and phosphate solubilizing bacteria in addition to the application of recommended dose of fertilizers enabled the crop to produce more nodules at 30 and 60 DAS in the second year. The supplement of potassium solubilizing bacteria along with *Rhizobium* and phosphate solubilizing bacteria with recommended dose of fertilizers was most promising. Maximum number of 24.15 and 25.95 nodules $plant^{-1}$ was recorded at 30 DAS in the year 2014 and 2015. Singh (2007) also recorded significant improvement in number of nodules $plant^{-1}$ by the combined application of *Rhizobium* and *Pseudomonas* with 5 t ha^{-1} FYM over the recommended dose of fertilizers. The interaction effects due to microbial inoculation on nodules] $plant^{-1}$ of soybean did not change significantly by the weed management practices.

Table 1. Nodules $plant^{-1}$ in soybean plant as influenced by weed management treatments and bio-fertilizers during *kharif* 2014 and 2015

Treatment	2014			2015		
	30 DAS	60 DAS	At Harvest	30 DAS	60 DAS	At Harvest
Weed Management						
W1:PE Pendimethalin @ 1kg *a.i* ha^{-1}fb Hand weeding at 25 DAS	24.00	24.42	19.08	26.85	26.00	23.25
W2:PE Pendimethalin @ 1kg *a.i* ha^{-1}fb PoE Imazethapyr @100 g *a.i* ha^{-1}+ Quizalofop- P-ethyl @50 g *a.i* ha^{-1}25 DAS	19.00	22.25	17.66	20.00	23.10	21.08
W3:PE Pendimethalin @ 1kg *a.i* ha^{-1}fb PoE Imazethapyr + Imazamox @ 70 g *a.i* ha^{-1} 25DAS	20.00	23.83	18.83	21.00	24.70	22.66
W4: Hand weeding at 25 and 45 DAS	25.95	27.53	21.91	27.18	27.91	25.91
W5: Unweeded check	24.78	25.95	19.54	25.79	26.33	23.66

Treatment	2014			2015		
	30 DAS	60 DAS	At Harvest	30 DAS	60 DAS	At Harvest
SE±	1.26	1.36	1.23	1.64	1.47	1.34
CD(P=0.05)	3.00	NS	NS	3.85	NS	NS
Bio-fertilizers						
F1: Fertilizers @ 30:60:40 kg ha^{-1} $N:P_2O_5:K_2O$	20.65	23.00	19.13	21.75	25.13	22.86
F2: F1 + Rhizobium @ 250 g10 kg^{-1} seed	23.32	25.18	19.36	24.80	25.53	23.20
F3: F2 + Phosphate solubilising bacteria @ 5 kg ha^{-1}	23.00	25.00	19.53	24.15	25.60	23.33
F4: F3+ Potassium solubilising bacteria @ 5 kg ha^{-1}	24.15	26.01	19.60	25.95	26.13	23.86
SE±	0.97	1.02	1.05	0.98	0.96	1.02
CD(P=0.05)	2.00	NS	NS	2.02	NS	NS
Interaction between Weed Management Bio-fertilizers						
SEM±	2.17	2.28	2.35	2.20	2.16	2.28
CD(P=0.05)	NS	NS	NS	NS	NS	NS

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Research note
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GENETIC DIVERGENCE STUDIES IN FARMERS' VARIETIES OF RICE (*Oryza sativa* L.)

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Rice (*Oryza sativa* L.) is the most important cereal of the world providing 21% of global human per capita energy and 15% of per capita protein. The process of dispersal during domestification, rice has evolved into a tremendously broad base for genetic diversity as reflected by number of land races existing today (Shivapriya and Hittalmani, 2006). India is one of the centres of origin for rice, a large number of native varieties and land races having unique characteristics and great adaptability are grown in different agro-climatic zones. To formulate a sustainable breeding program precise knowledge about genetic divergence for yield components is crucial as varietal improvement depends mainly on the selection of parents with high genetic divergence. The divergence can be studied by technique using D^2 statistics. The present investigation was aimed to estimate the magnitude of genetic divergence present in the 75 farmers' varieties of rice through D^2 statistics and to identify the diverse genotypes for use in future breeding programmes.

Seventy five farmers' varieties of rice were obtained from Central Rice Research Institute, Orissa transplanted in the Randomized Block Design with 3 replications during *Rabi,* 2012 at Directorate of Rice Research farm, ICRISAT Campus, Hyderabad, situated at 17.53^o N latitude, 78.27^0 E longitude and altitude of 545m above mean sea level. In each replication, single seedling was transplanted per hill in 6 rows with 20 x15 cm spacing. All necessary cultural operations and management practices were employed as and when necessary. The observations were recorded on five randomly taken plants from each replication for time of heading, stem length, total number of tillers per plant, number of productive tillers per plant, panicle length, number of filled grains per panicle, 1000 grain weight, grain yield per plant, decorticated grain length, decorticated grain width and L/B ratio. Genetic diversity was worked out following Mahalanobis' (1936) generalized distance (D^2) analysis. Clustering of genotypes was done according to Tochers method (Rao, 1952). All the statistical analysis was carried out using Windostat Version 9.1 computer software.

Analysis of variance revealed the significant differences among the varieties for all the traits studied indicating a considerable amount of genetic variability for the characters and therefore divergence analysis was carried out.

Based on D^2 values the genotypes were grouped into eleven clusters using Tocher's method given in Table 1. Maximum number of varieties (64) were included in cluster I followed by two varieties in cluster IV. Remaining clusters were solitary. Varieties from same geographic location fell into different clusters indicating that clustering of populations did not follow their geographic or location distribution. Similar results were reported by Hosan *et al.* (2010), Garg *et al*. (2011).

The average D^2 values within (intra) and between (inter) clusters were given in Table 2. The inter cluster distances were higher than the average intra cluster distances, which indicated wide genetic diversity among the genotypes of different groups than those of the same cluster. Maximum intra-cluster distance was observed in cluster I (131.18), followed by cluster IV (59.99), indicating genetic diversity among the varieties of these clusters. The minimum intra-cluster distance was observed in clusters II, III, V, VI, VII, VIII, IX, X and XI. Higher inter cluster distances were

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observed between cluster IX and cluster X (1101.06) followed by cluster II and cluster XI (996.88), cluster VII and cluster X (891.82) and cluster VI and cluster IX (880.00), while it was low between cluster V and cluster VII (116.02) followed by cluster VI and cluster VIII (121.00) and cluster II and cluster VI (131.79). Thus, it can be suggested that, crosses involving parents belonging to the most divergent clusters would be expected to manifest maximum heterosis and wide variability for different traits. These results are in consonance with the findings of Souroush *et al*. (2004), Sandhya Kishore *et al.* (2007).

The diversity was also supported by the appreciable amount of variation among the cluster means for different characters. Cluster means and relative contribution towards genetic divergence for eleven yield and yield contributing characters are depicted in Table 3. The cluster III is having highest mean value for grain yield per plant and decorticated grain width, cluster IV for total number of tillers per plant and number of productive tillers per plant, cluster V for 1000-grain weight and cluster VIII for number of filled grains per panicle. Thus, these varieties hold great promise as parents for obtaining promising elite lines through hybridization and to create further variability for these characters (Mishra and Pravin, 2004). The contribution of individual trait to the divergence among varieties is indicated the Table 3. The characters viz., decorticated grain length, time of heading, decorticated grain width, L/B ratio, grain yield per plant and number of productive tillers per plant contributed 90.71% of the total divergence and these traits were found to be important for genetic differentiation in varieties. These results are in accordance with finding of Garg et al. (2011). The present study indicated the diversity among the genotypes and selection of desirable genotype for a particular trait that may likely to help in rice improvement programme.

Table 1. Distribution of 75 farmers Rice varieties into different clusters

Cluster	Number	Genotypes
I	64	Kohila, Kantadomer, Danisaria, Marfal, Biramani, Khursudi, Setka, Karni, Katakichampa, Dasaharadhan, Kalagoda, Bitisapari, Chheligudi, Kusuma, Samudra, Kainchi, Pugakals, Gelei, Butachudi, Mahulakunchi, Badrangi, Kanhei, Bodikaberi, Sikla, Ratanchudi, Kakudia, Umurichudi, Bakka, Agnyasal, Lalgori, Kading, Pora, Kandasuri, Butasori, Raajamani, Bagadachinamal, Lalkain, Khandabhuta, Jhitpiti, Basantinhog, Chinger, Kinari, Parakunja, Malati, Kabirangi, Karnga, Kharakoili, Malkadua, Guakati, Dengabari, Keral, Harishankar, Sadhana, Hiran, Kalachudi, Kakudimanji, Asumakundo, Paugi, Chingudi, Kanakamasuri, Bhatta sakuli, Jaygopal, Pnenin, GotraB.
II	1	Mahulata
III	1	Saria
IV	2	Sitabhog, Sunakhadi
V	1	Baikani
VI	1	Aganisali
VII	1	Kaljira
VIII	1	Padma
IX	1	Kundo
X	1	Badkleshari
XI	1	Govindabhoga

Table 3. Cluster means and relative contribution towards genetic divergence for eleven yieldand yield contributing characters

Cluster	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	Times ranked 1st	Contribu-bution(%)
TH	114.04	140.33	108.67	118.5	85.67	138.33	80.33	146	82	125.33	83.33	718	25.87
SL(cm)	115.8	148.24	110.05	121.09	129.01	148.71	97.36	112.68	107.92	130.39	94.4	77	2.77
TNTP	22.6	16.39	28.33	30.68	18.63	18.53	15.03	19.68	22.67	28.74	25.37	16	0.57
NPTP	18.91	14.93	23.33	26.8	13.43	15.27	11.9	17.34	18.68	26.00	22.5	94	3.38
PL(cm)	22.44	30.43	24.15	17.02	22.7	37.49	31.57	22.58	22.17	21.27	26.84	61	2.19
NFGP	103.58	115.38	67.51	98.91	103.87	142.9	182.53	238.5	87.97	179.32	101.87	40	1.44
TGW(g)	23.19	24.28	26	13.57	26.29	20.62	23.93	13.12	20.13	15.03	10.95	63	2.27
GYP(g)	18.29	18.21	23.2	14.47	14.5	12.59	19.84	22.05	20.65	20.21	9.87	98	3.53
DL (mm)	5.63	5.73	5.51	5.21	5.47	5.05	5.52	5.21	5.92	3.73	4.13	881	31.74
DW(mm)	1.55	1.62	1.91	1.22	1.75	1.42	1.53	1.36	1.38	1.61	1.32	584	21.04
L/B ratio	3.64	3.54	2.88	4.27	3.12	3.57	3.6	3.84	4.3	2.32	3.12	143	5.15

TH: Time of heading (days to 50 % plants with heads), SL: Stem length, TNTP: Total number of tillers per plant, NPTP: Number of productive tillers per plant, PL: Panicle length, NFGP: Number of filled grains per panicle, TGW: 1000 grain weight, GYP: Grain yield per plant, DL: Decorticated grain length, DW: Decorticated grain width and L/B ratio.

Table 2. Average intra-(diagonal and bold) and inter-cluster D^2 estimates in Rice

Cluster	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
I	**131.18**	249.98	264.50	345.48	234.33	368.84	314.15	378.58	347.86	534.88	538.64
II		**0.00**	386.36	527.51	577.15	131.79	736.21	212.52	844.97	516.58	996.88
III			**0.00**	803.02	226.95	707.24	520.23	785.31	625.55	588.43	846.33
IV				**59.99**	634.40	371.15	566.14	286.08	374.26	573.58	415.46
V					**0.00**	749.99	116.02	838.67	251.35	719.47	436.97
VI						**0.00**	761.08	121.00	880.00	389.19	737.97
VII							**0.00**	828.16	134.05	891.82	307.51
VIII								**0.00**	872.59	397.48	800.78
IX									**0.00**	1101.06	385.37
X										**0.00**	536.01
XI											**0.00**

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Research note
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CONSUMER PURCHASE BEHAVIOUR AND BRAND PREFERENCES OF VARIOUS READY TO EAT BREAKFAST CEREALS – A CASE OF HYDERABAD METRO

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Breakfast is regarded by many nutritionists as the most important meal of the day. Breakfast provides a significant proportion of the day's total nutrient intake and offers the opportunity to eat food with nutrients, vitamins and fiber. All over the world, cereals are used as staple food and are the cheapest source of energy and protein in human diet. Breakfast cereals are defined as "Processed grain formulations suitable for human consumption without further cooking".

In India, majority of food consumption is still at home. Nevertheless, out-of-home food consumption is increasing due to increase in urbanization, breaking up of the traditional joint family system, desire for quality time which translates into an increased need for convenience, increasing number of working women, rise in per capita income, changing lifestyles and increasing level of affluence in the middle income group had brought about changes in food habits (Landstro *et.al.* 2011).

In the modern days, where the life is at fast pace with the time very valuable to every person, "Instant Foods" play an important role in everyone's day-to-day life. The very term 'instant food' means simple, fast and convenient food, which is easy and fast to prepare besides being hygienic, free from microbial contamination and also ready to eat. The influence of western countries, more global trade, traveling *etc*., hence, people are changing their taste to ready-to-eat breakfast foods more compared to the old traditionally prepared breakfast foods. In the modern era, the media, particularly electronic and print media, are playing an important role in creating awareness of the products manufactured and released in the market. All these factors are responsible for the popularity of ready-to-eat breakfast food products in Indian market. Capitalizing this situation, several firms are being engaged in production and marketing of breakfast cereal products which provides greater options to the consumers (Kalaiselvi and Mohanapriya 2015).

This study was conducted to find out the consumers purchase behavior and brand preferences about Ready to Eat breakfast foods in Hyderabad metro.

A sample of 240 households/consumers has been randomly selected from 8 different centres of Hyderabad i.e., 30 consumers from each centre. The centres identified were Nacharam and Cherlapally from the East direction, Panjagutta and Ameerpet from the West direction, Jeedimetla and Kompally from the North direction, Rajendranagar and Attapur from the South direction. Rank Based Quotient (RBQ) was used to rank the consumers preferences and perceptions.

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Table 1. Consumer purchase behaviour about RTE food products in the study area

S.No	Parameters	Safed musli		Corn flakes		Oats		Pasta/noodles		Bread	
		RBQ score	Rank	RBQ score	Rank	RBQ score	Rank	RBQ score	Rank	RBQ score	Rank
1	Price	76.9	6	80.1	6	74.2	6	82.4	3	82.1	6
2	Availability	81.2	5	83.2	4	87.4	3	75.2	5	90.2	3
3	Keeping quality	91.2	2	89.8	2	90.4	2	89.2	2	92.2	1
4	Taste	85.5	4	81.2	5	82.2	5	91.9	1	88.9	4
5	Healthy and nutritious	91.6	1	90.9	1	91.5	1	73.1	6	91.4	2
6	Convenience	87.4	3	83.6	3	86.2	4	81.2	4	86.1	5

The consumers purchase decisions of RTE breakfast cereal foods is influenced by several factors. These factors will be of lot of use to the businesses in formulating their strategies and in channelizing their efforts. Therefore an attempt has been made to identify the influencing factors in the consumer decision making for various product categories.

The results of analysis for the safed musli product revealed that healthy and nutritious and keeping quality are the leading parameters and therefore highly influencing factors ranked at 1st and 2nd position with scores of 91.60 and 91.20. The results have ranked convenience and taste of the product as moderately influencing factors ranking at 3rd and 4th positions with scores of 87.4 and 85.5. Availability and price are the less influencing factors ranked at 5th and 6th positions with scores of 81.20 and 76.90.

The results of analysis for corn flakes revealed that healthy and nutritious and keeping quality are the leading parameters as highly influencing factors ranked as 1st and 2nd with scores of 90.90 and 89.80. Convenience and availability of the product are moderately influencing factors ranked as 3rd and 4th with scores of 83.60 and 83.20. Taste and price are the less influencing factors ranked as 5th and 6th with scores of 81.20 and 76.90 respectively.

The results of analysis for oats revealed that healthy and nutritious and high keeping quality are the leading parameters which are highly influencing ranked as 1st and 2nd with scores of 91.50 and 90.40. Availability and convenience of the product are moderately influencing factors ranked as 3rd and 4th with scores of 87.40 and 86.50. Taste and price are the less influencing factors ranked as 5th and 6th with scores of 82.20 and 74.20 respectively.

The results of analysis for pasta/noodles revealed that taste and good keeping quality are the important parameters and are highly influencing factors and therefore ranked at 1st and 2nd position with score of 91.90 and 89.2. Price and convenience of the product are moderately influencing factors ranked at 3rd and 4th position with scores of 82.40 and 81.20. Availability and healthy and nutritious are the less influencing factors ranked at 5th and 6th place with scores of 75.20 and 73.10 respectively.

The results of analysis for bread revealed that keeping quality and healthy and nutritious are highly influencing factors and therefore ranked at 1st and 2nd position with scores of 92.20 and 91.40. Availability and taste of the product are moderately influencing factors ranked at 3rd and 4th place with scores of 90.2 and 88.90. Convenience and price are the less influencing factors ranked as 5th and 6th with scores of 86.10 and 82.10 respectively.

Thus it can be inferred that keeping quality and healthy and nutritious are the most important parameters considered while making purchase decisions.

Table 2. Consumer preference for various brands of RTE food products in the study area

S. No	Product Category	Brand Name	No. of Respondents	Percentage
1	Safed Musli	Kellogs	173	72.08
		Mohans	37	15.41
		Nutricrisp	30	12.50
2	Corn flakes	Kellogs	105	43.75
		Mohans	77	32.08
		Nutricrisp	58	24.16
3	Oats	Quakers	135	56.25
		Saffola	105	43.75
4	Pasta/Noodles	Maggi	91	37.91
		Knorr	63	26.25
		Yippee	53	22.08
		Top Ramen	33	13.75
5	Bread	Modern	89	37.08
		Britannia	78	32.50
		Spencer	73	30.41

Brand preference is one of the parameter which determines the brand value of the company's products. An attempt was made to seek the choice of the customers for various brands listed under each product category. The results revealed that 72.08 per cent of the consumers first choice under the safed musli product category was Kellogs, Mohan brand was preferred by 15.41 per cent of the people and only 12.5 per cent of the sample respondents preferred Nutricrisp. Among the RTE corn flakes category, the results revealed that 43.75 per cent of the consumers first choice was Kellogs, Mohan brand was preferred by 32.08 per cent of the people and only 24.16 per cent of the sample respondents preferred Nutricrisp. Kellogs is the multinational brand, has long time presence in the market and spends considerable budget on promotional measures and therefore preferred by majority of the consumers. Mohan brand is preferred due to its low price and has good hold in the local market. Among the oats category, Quakers brand is the first choice by majority of the respondents (56.25 %), followed by Saffola brand (43.75 per cent). In the pasta/noodles category, Maggi is taking a lead with 37.91 per cent of customers making it as their first choice followed by Knorr with 26.25 per cent, Yippee with 22.08 per cent and Top Ramen with 13.75 per cent. In the bread category, Modern is taking a lead with 37.08 per cent of customers making it as their first choice followed by Britannia with 32.5 per cent and Spencer with 30.41 per cent. Thus it can be inferred that the Kellogs, Quakers, Maggi and Modern brand were the highest preferred brands in each of the product category of RTE breakfast products (Bhupta Malini, 2006).

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Research note
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MAGNITUDE OF DEVELOPMENTAL DELAYS AMONG TRIBAL CHILDREN AND EFFECT OF EARLY INTERVENTION

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Infancy and early childhood are the paramount for prevention and amelioration of problems that could potentially cause developmental difficulties and affect brain development across the lifespan. Developmental delay refers to a child not achieving 'developmental milestones' at the right age. These 'milestones' refer to sets of functional skills or age-specific tasks that most children can do in a certain age-range. Delays may be in physical ability or cognitive ability. Identifying such lags and intervening at the earliest can prevent disability to a large extent in children. India has 2.04 million disabled children aged between 0 and 6 years. Around 71 percent of them i.e., 1.45 million are in rural areas, as per the 2011 Census. Tribals are one of the most vulnerable groups in India. In spite of various kinds of policies and programs they remain the most excluded and stay in miserable conditions due to various factors such as geographical isolation, poor healthcare delivery systems, beliefs and customs. Exclusion from development has adversely affected the tribal children too. Infant mortality, child mortality and under-five mortality among tribal was high 84.2 %, 46.3 % and 12.6 % respectively in comparison to general population (67.6 %, 29.3 % and 94.9 per cent) respectively in 2002. Similarly, as compared to the general population (51.8 per cent) a high number of tribal children were undernourished (64.9 per cent) (Xaxa, 2011). The optimal development of the child must be ensured during early years by avoiding as much as possible perinatal, genetic, metabolic and environmental risk factors. Globally, about 200 million children do not reach their developmental potential in the first five years because of poverty, poor health, nutrition and lack of early stimulation. The World Health Organization estimates that 15-20% of children, worldwide, have disabilities; 85% of which are in developing countries. Children are placed at genetic risk by being born with a genetic or chromosomal abnormality. Environmental risk results from exposure to harmful factors either before or after birth and include poor maternal nutrition, maternal stress, poverty, exposure of pregnant mother to certain drugs, toxins, irradiation and infections that are passed from a mother to her baby during pregnancy or birth. Children born prematurely are at a greater risk of developing developmental delay. Besides above factors, birth asphyxia, birth injuries, neonatal sepsis, hyper bilirubinaemia etc may also contribute to developmental delay. Motor development, which allows infants to explore their environment, promoting cognitive, social and perceptual development, can be influenced by cultural practices and nutritional factors. Advances in motor development allow infants to explore their environment, promoting cognitive, social and perceptual development (Kariger *et al.*2005). Adequate motor development is necessary for visual-perceptual and cognitive development in infancy. With increased locomotion, infants are able to reach new objects and new places, increasing opportunities for exploration. Motor development has been traditionally divided into gross and fine. Gross motor development, which includes overall body movement abilities, has been shown to influence infants' independence and self care. For example, walking without assistance is followed by emotional changes reflecting autonomy and assertiveness, promoting social skills, attachment and such interactions as social referencing (Biringen *et al.*1995).

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Early intervention has been proven to be effective in facilitating development in children with developmental delay. Early intervention in developmental delayed children is very crucial for enhancing their overall development (Donald, *et. al.*2004). Poor awareness, low literary, absence of training among potential intervention professionals, poor transportation, inadequate facilities and cultural beliefs, myths and misconceptions affect early intervention services (Lakhan and Sharma, 2010). Early the intervention, the more positive is the outcome in children (Ramey and Landesman 1998). Early intervention enhances the developmental ability of receivers and prevents or minimizes developmental delay in children. Physical developments are found to be affected by the environment no less than psychological ones. A healthy environment is necessary for normal growth of the body, brain, and nervous system of preschoolers (UNICEF, 2013). From the above review it was found that early intervention has been proven to be effective in children with developmental delay. Hence, the study aimed at to assess the developmental status of children among the tribal families. Objectives were to study the general profile of tribal families, to assess and improve the developmental status of children among tribal families early intervention.

Experimental design was adopted for the study to intervene and observe the post intervention scores on developmental status of the children. In total sixty tribal families were selected and all the children below three years of age were assessed by using Bayley scale. A total thirty children were selected for intervention and purposive sampling technique was used for selecting the family children based on age. Family children were selected from the tribal villages of Mahabubnagar district. Bayley scale of infant development was used for the study to assess the developmental delays among the children. Interview schedule was used for collecting the general information of the family children. Stimulation activities were planned based on delayed development and implementation of early intervention was carried out with the help of mothers of children.

Intervention programme for children with developmental delays :

Intervention programme was planned for infants along with parents to improve the motor and cognitive skills. Parents were educated about developmental delay signs and understand importance of intervention. Weekly stimulation activities were carried out by the investigator with help of aganwaadi helpers and parents for a period of four months.

Selection of sample for Developmental intervention:

Total ten children from age group below six months and six to twelve months were selected for the early intervention. Five children from age group thirteen to nineteen months and twenty to twenty six months were selected for the early intervention. Total children for early intervention programme comprised of thirty children under experimental group and fifteen children for control group. These children were selected from the research sample. Total three intervention groups were formed from all the three villages. Each intervention group comprised of six children below one year and four children from thirteen to twenty six months.

Table 1. Distribution of children into groups according to age

Group Number	Age
First group	< 6 months
Second group	6 - 12 months
Third group	13-19 months
Fourth group	20-26 months

Intervention plans were developed based on performance on Bayley Scales of Infant Development (BSID) in consultation with experts.

Developmental Status of Children in Tribal Families

The development that occurs from birth to 3 years provides the foundation for subsequent development across domains. Infant / toddler development proceeds in a predictable sequence. Infants crawl before they walk, babble before they talk and so on but development varies from child to child. This integration of development across domains has implications for the overall course of a child's development. A developmental disability or delay identified in any one area will affect other developmental domains as well. In present intervention study the developmental status of the tribal infant and toddlers was assessed using Bayley scale of Infant development. The results obtained were discussed and presented in the following tables.

Table 2. Distribution of children based on developmental status of Tribal Infants (N=90)

Score range	Classification	Motor Scale				Mental Scale			
		Age in months				Age in months			
		<6 (n=24)	6-12 (n=21)	13 -19 (n=17)	20 -26 (n=28)	<6	6-12	13 -19	20-26
69 below	Significantly delayed performance	7 (30%)	4	3	9	6	5	3	10
70-84	Mildly delayed performance	5(21%)	6	3	8	5	7	4	7
85-114	Within normal limit	10	8	9	11	11	8	9	10
115 and above	Accelerated performance	2	3	2	-	2	1	1	1
Total		24	21	17	25	24	21	17	25

From the above table we can conclude that the developmental status of tribal infants on motor and mental domains revealed nearly 50 percent of the children were having low developmental status. If these children were neglected or no early intervention was provided to these children they may develop delayed motor and mental abilities. The well nourished children were able to attain the milestones at a younger age in the five areas of development compared to undernourished children. It can be concluded that poor living conditions or resource poor environment, low parent and child interactions and nutritional status of children could be the factors affecting the development of children.

Table 3. Developmental status of experimental group and control group before intervention

Scales	Age in months	Experimental (n=30)		Control (n=15)		t value	p value
		Mean	SD	Mean	SD		
Mental Scale	<6	69.8	3.17	68.5	3.92	1.174	0.24
	6 -12	74.4	2.76	75.2	3.09	0.862	0.393
	13 -19	71.2	1.98	69.8	2.98	1.851	0.08
	20 -26	73.2	4.86	71.2	3.93	1.345	0.185
	>6	70.8	3.88	69.9	4.32	0.691	0.493
	6 -12	80.5	3.78	80.6	4.08	0.079	0.936
	13 -19	77.0	4.02	76.8	3.76	0.1568	0.87
	20 -26	72.1	3.13	74.1	4.12	1.782	0.081

p>0.05 level of significance

It was found that mean scores of experimental group were almost similar with that of control group scores. There is no significant difference between the two groups before intervention.

Intervention like early stimulation for infants, awareness, education and training to the parents on developmental mile stones, child care practices, stimulating activities with indigenous material helped the children who were to face developmental delays had improved their developmental status to normal. All the experimental group excepting less percentage moved to normal limit due to early intervention programme.

Table 4. Developmental status of tribal infants after intervention (N=30)

Score range	Classification	Motor Scale				Mental Scale			
		Age in months				Age in months			
		>12 (n=3)	12-18 (n=8)	18 -24 (n=14)	24 -30 (n=5)	>12 (n=3)	12-18 (n=8)	18 -24 (n=14)	24-30 (n=5)
69 below	Significantly delayed performance	-	-	-	-	-	-	-	-
70-84	Mildly delayed performance	-	-	2(14%)	1(20%)	-	1(13%)	2(14%)	1(20%)
85-114	Within normal limit	3(100%)	8(100%)	12(86%)	4 (80%)	3(100%)	7(87%)	12(86%)	4(80%)
115 and above	Accelerated performance	-	-	-	-	-	-	-	-

Table 5. Impact of intervention on developmental status of tribal infants

Scales	Age in months	Pre intervention		Post intervention		t value	p value
		Mean	SD	Mean	SD		
Motor Scale	<6	69.8	3.17	97.3	2.75	35.89	0.0001*
	6-12	74.4	2.76	101.7	3.1	36.025	0.0001*
	13-19	71.2	1.98	112.3	1.89	82.2	0.0001*
	20-26	73.2	4.86	98.9	2.07	26.64	0.0001*
Mental Scale	<6	70.8	3.88	91.7	3.05	23.191	0.0001*
	6-12	80.5	3.78	102.6	1.98	28.366	0.0001*
	13-19	77.0	4.02	99.73	2.37	26.581	0.0001*
	20-26	72.1	3.13	109.4	1.86	56.11	0.0001*

p<0.01 level of significance

The pre and post test bayley mean score (Table 5) concludes that there was a significant difference in motor and mental score in the experimental group, before and after intervention.

Significant difference was found in the mean scores of experimental group before and after intervention. Early childhood development could be enhanced in a poor resource setting, through community based intervention. Some of the low cost, low resource-intensive community practices for the target age-group is to play, read, listen to music and through tactile stimulation. From this study it can be concluded that effective interventions enhance early childhood development.

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Research note
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PERCEPTIONS OF RURAL ADOLESCENTS ON BODY IMAGE

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Adolescence is a period of transition from childhood to adulthood marked by perceptible physical, biological and emotional changes which leads to increased concern about physical appearance. Body image refers to how an individual thinks, feels and behaves in relation to their body and appearance. It is a multidimensional construct consisting of perceptual, cognitive, affective and behavioral elements (Paxton, 2011). Body image in adolescent girls tend to be related to particular features of the body like weight and shape and for boys skin complexion, facial features, body hair, fitness, muscularity and strength are common concerns (Wertheim and Paxton, 2009).

Adolescent's self-images about how beautiful they are strongly tied to their perceptions about body and also the feedback they receive from the significant people in their life i.e. parents, family members and peer group, this is true for both the sexes. However, positive communication about appearance by peers and family members have a positive impact on body image perceptions and body satisfaction of adolescents. It is widely known fact that when an individual fits into the social norms and cultural ideals they feel more contended.

The present study was conducted in the colleges in and around the villages of Warangal and Hanmakonda of Warangal district, Telangana with an Expost- facto research design. Simple random sampling procedure was adopted in selecting the institutions and adolescents. The sample of the study comprised of questioning of 180 adolescents from the institutions in the age range of 16-18 years.

The data was collected by using sub component of Body image perception schedule developed by Divya.V and Mayuri,K (2014).

Scoring: The scoring pattern for each item is as follows Agree-3, Undecided- 2, Disagree-1. With the help of scoring pattern, raw scores were calculated and then they were checked against the level of perceptions about body image. i.e. 1-8 indicates low positive body image perceptions, 9-16 indicates moderate positive body image perceptions, 17-24 indicates high positive body image perceptions. The collected data was coded and analyzed by using frequencies and percentages.

Table 1. Perceptions of rural adolescents on body image

S.No	Statements	Agree		Undecided		Disagree	
		F	%	F	%	F	%
1.	Looking beautiful/ handsome is most important for success in life	96	53	7	4	77	43
2.	Beautiful people get more advantages in life	91	51	22	12	67	37
3.	No other talent can replace physical beauty	47	26	34	19	99	55
4.	It is important to try and look as beautiful as possible	66	37	24	13	90	50
5.	It is important to spend money in order to look beautiful	42	23	30	17	108	60
6.	Beautiful people need not try very hard to succeed	62	34	30	17	88	49
7.	Beautiful people are loved more by others	110	61	15	8	55	31
8.	Happiness depends on how beautiful one is	94	52	24	13	62	35

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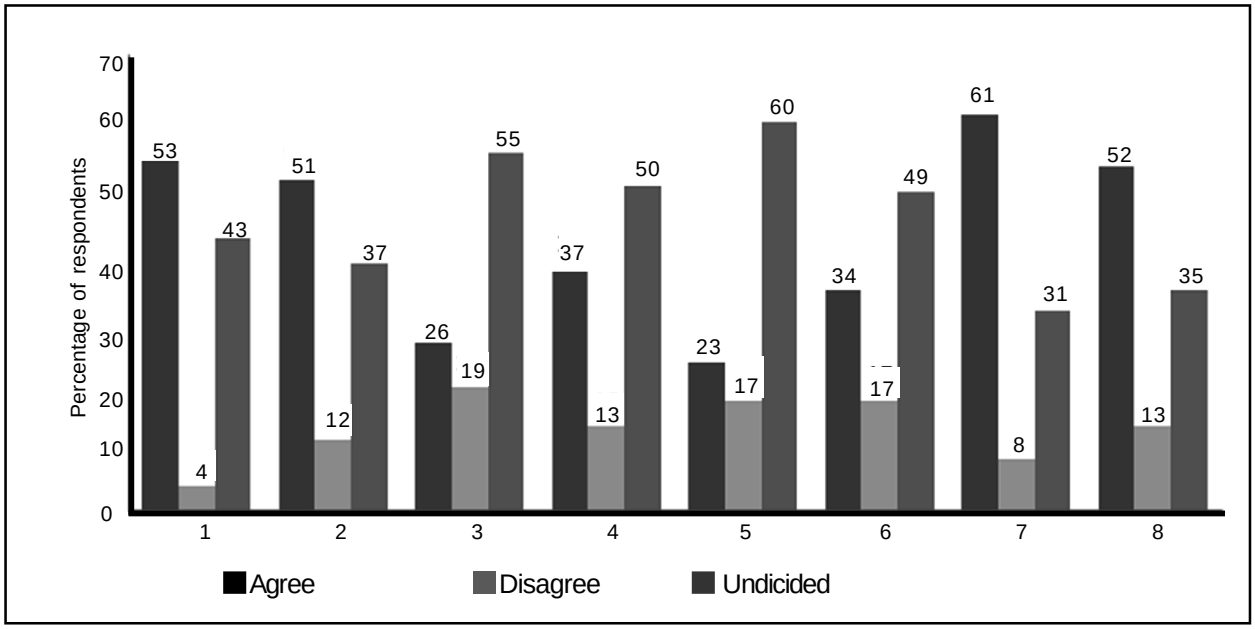

Figure.1 Perceptions of rural adolescents on body image

1. Looking beautiful/ handsome is most important for success in life
2. Beautiful people get more advantages in life
3. No other talent can replace physical beauty
4. It is important to try and look as beautiful as possible
5. It is important to spend money in order to look beautiful
6. Beautiful people need not try very hard to succeed
7. Beautiful people are loved more by others
8. Happiness depends on how beautiful one is

From the above table, it was revealed that nearly two thirds (61%) of the respondents agreed on the concept of "beautiful people are loved more by others". More than half (53%) of the respondents agreed that looking beautiful/ handsome is most important for success in life.

It was also revealed that happiness also depends upon the beauty of oneself. Half of the respondents (51%) had also agreed that beautiful people gain more advantages in life and it is important to try and look as beautiful as possible.

Thirty four percent of the respondents have agreed and given positive responses on the concepts of beauty like beautiful people are luckiest and need not try hard for success. This might have influenced them to give highest priority to beauty to achieve good status in the society and lead a happy life.

Nearly, one fifth (19%) of the respondents were not able to decide with the concept of no other talent can replace physical beauty followed by spending more money in order to look beautiful (17%) and also need not try very hard to succeed (17%). This might be because they were having feeling on physical appearance/ body image.

At the same time more than half of the respondents (60%) disagreed on the concept of spending more money in order to look beautiful followed by no other talent can replace physical beauty. (55% and also 50% people disagreed that it is not that important to try and look beautiful as possible. It might be parents and close friends love irrespective of physical appearance. Hence, half of the adolescents have not genes weightage to beauty. Similar results were noted by Divya and Mayuri, (2014) in their study on body image perceptions of urban adolescents.

The study was helpful in understanding the perceptions of rural adolescents about their body image. In general, adolescents perceive their body image by comparing themselves to the models from glamour world and get unrealistic goals which make them feel dissatisfied as they are unable to reach their

impractical goals. The counselors and policy makers should organize educational programs with regard to body image perceptions and their consequences, fake advertisements like artificial weight reduction methods, face creams, pills to reduce weight, awareness campaigns, etc. Counseling is also very much required for adolescents' parents too.

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Research note
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A STUDY ON THE CONSTRAINTS FACED BY THE BANK AND THE FARMERS WITH REGARD TO CREDIT LENDING AND REPAYMENT IN MAHBUBNAGAR DISTRICT OF TELANGANA

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Rural indebtedness is an age-old problem in India. In the nineteenth century, commercial banking was non-existent in rural areas, and farmers were completely in the hands of usurious moneylenders. Starting from the days of British rule, the central government has been striving to expand institutional lending to the rural agricultural sector. In recent decades, efforts in this direction have intensified and today, there is a vast network of institutions providing credit for agriculture (Mehta and Malhotra 2014) (Misra and Dhal 2010).

Credit is a catalyst that lubricates the process to accelerate the farm and non-farm sector development including rural industrialization, business and service segments of the economy. Credit helps farmers invest in creating assets to generate output and income through deploying science, technology and modern methods of business management. Investments in farm can generate farm income sustainably when credit is simultaneously adequately supported by backward and forward linkages, viz. inputs of production, technology and services (Michael and Vasanthi. 2006) .

The survey was conducted in Mahbubnagar district of Telangana and a total of 4 mandals were identified to conduct the survey related to farmers. The identified mandals were Kalwakurthy, Kollapur, Makthal, Mahabubnagar and 2 villages from each mandal were identified and 20 farmers from each mandal were approached. Also, an Agriculture Officer, 2 Field Officers, an Assistant Manager of Bank and three Specialist Officers were approached. Therefore, a total of 80 farmers and 7 officials were selected for the study.

The data was collected from both primary sources and secondary sources. Primary data was collected from Farmers and Bank Officials. The primary data regarding the constraints faced by the farmers to repay the loans was collected from farmers and the constraints faced by the Banks to lend the loans were collected from the concerned Bank Officials. The secondary sources of information were journals, books, websites and bank records.

Constraints faced by the farmers to repay the loans and also the bankers to lend the loans

In the process of studying the various constraints usually faced by the farmers to repay the loans, the following were the majority of factors emerged during the research and were documented accordingly. The data collected against each factor was considered and a result was obtained by using the Garrett Ranking method.

Table 1.Constraints faced by the farmers to repay the loans

Factor	Constraints	Average score	Rank
F1	Heavy borrowing	32	1
F2	Crop failure	30	2
F3	Other reasons like political influences	25	3
F4	Willful default	24	4
F5	Diversion of loans to other uses	15	5

Source: Primary survey, 2017

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The analysis stated that heavy borrowing and crop failure were the major factors that led to not repaying of the loans by the farmers, which ranks these factors as 1st and 2nd in the enlisted factors with a total score of 32 and 30 respectively. The analysis has stated the other reasons like political influences as a factor with 3rd rank and a total score of 25. The analysis has listed the factors like willful default and diversion of loans to other uses at 4th and 5th ranks respectively at an average score of 24 and 15.

There were also other reasons like, loans were not given without any security, corrupt practices of banks, high transaction costs, ambiguity in some terms and conditions, complicated and long procedure, more beneficial only to large farmers.

Table 2. Problems in the banks which lead to improper credit lending and management

Factor	Constraints	Average score	Rank
F1	Lack of timely actions	34	1
F2	Lack of adequate efforts	22	2
F3	Inefficient feasibility studies	21	3
F4	Management deficiencies during work	10	4
F5	Lack of proper verification of genuine purpose of loan advances	7	5

Source: Primary survey, 2017

The ranking procedure stated that lack of timely actions by the bank was one of the major reasons for the assets becoming non-performing in nature, which ranks it at 1st position with an average score of 34. The study revealed that lack of adequate efforts by both the sides i.e. by the bank and the farmers to propel or repay the loans was also a major factor of concern with a ranking at 2nd position with an average score of 22. Inefficient feasibility studies and management deficiencies during work were at 3rd and 4th ranks respectively with average scores of 21 and 10. The reason like lack of proper verification of genuine purpose of loan advancement was neglected, which ranked at the 5th position, with an average score of 7.

Farmers faced many problems regarding repayment of the loans due to reasons like crop failure, heavy borrowings, diversion of the use of loan amount to other uses rather than for agriculture purposes and also obtaining a loan for no reason just to follow the unspoken trend of taking loans in the rural areas.

Farmers needed loans excessively for the mid-season operations, farm machinery, agriculture input purchases and other legal and personal matters.

The bankers responded on the improper management of NPAs by stating that lack of timely actions, lack of proper efforts, inefficient feasibility studies, management deficiencies during work and lack of proper verification of the loan purposes existed and had to be corrected on time. Also there were some NPA management measures realized, like, risk assessment and management, release of willful defaulters, better credit information bureau, increased collateral requirements, compromised settlement schemes, reporting the frauds to RBI, training and development of bank staff etc. More reasons were cited like, slow disbursement of subsidies by District Rural Development Agency, unhealthy competition and lack of coordination, lower cash deposit to total deposit ratio.

Suggestions

- Upgrading technology and computerization on regular intervals would help in getting required information in order to take decisions in case of advancing loans.
- Involvement of NGOs and other voluntary organizations to inculcate ethics in the borrowers and educate them regarding the importance of timely repayment of credit (Mishra and Pattanaik 2005).

- When the RBI grants new banking license, there should be a condition that for the first 10 years there cannot be any loan write-offs. Later, write off amounts must be borne by the shareholders, which is to be certified by external auditors. A separate statement should be made so that all stakeholders are aware to what extent their profits were affected due to the write-off (Narula and Singl 2014).
- The institutionalization of information sharing arrangement is now possible through the newly formed Credit information Bureau of India Limited (CIBIL) it was set up in the year 2001, by SBI, HDFC, and two foreign technology partners. This will prevent those who take advantage of lack of system of information sharing amongst leading institutions to borrow large amount against same assets and property, which has in no measures contributed to the incremental of NPAs of banks (Pathak. 2009).
- Circulation of Information of Defaulters should be carried out periodically. RBI has put in place a system for periodical circulation of details of willful defaulters of banks and financial institutions. RBI also publishes a list of borrowers (with outstanding aggregate rupees one crore and above) against whom banks and financial institutions in recovery of funds have filed suits as on 31 st March every year. This serves as a caution list while considering a request for new or additional credit limits from defaulting borrowing units and also from the directors, proprietors and partners of these entities (Poongavanam. 2011).

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Research note
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EFFECT OF SELENIUM, SULPHUR AND THEIR INTERACTION ON YIELD OF ONION *(Allium cepa*. L*)* AND SUNFLOWER *(Helianthus annus*. L*)*

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Selenium (Se) is an important trace element in animal and human nutrition but known as a non-essential element for plants, though its beneficial roles have been reported in the plants capable of accumulating large amount of the element (White *et al*. 2007). It plays an important role in body antioxidation system; it is considered as an individual antioxidant that can cooperate with other antioxidants such as vitamins C and E in the processes protecting the cells from free radicals.

Selenium acts as a cofactor in cellular detoxification of peroxidase. Low Se status in humans may increase the risk of cardiovascular diseases (CVD), cancer and other diseases like Alzheimers, which are caused by free radicals (Fairweather Tait *et al*. 2011). Selenium participates in thyroid hormone metabolism, immune system, inhibits virulence, and slows down the development of AIDS through reducing the speed of HIV development.

In India, onion is grown in an area of 1.17 m ha with a production of 18.77 m tons and ranks second in global onion production (NHRDF, 2014). Bulb onion (*Allium cepa* L.) is one of the major sources of dietary flavonoids in several countries (Knekt *et al*. 1996). Due to the substantial consumption and ability to accumulate Se, bulb onion could be one of the best vegetables for Se enrichment. Several studies have been performed to enrich onions with Se, but most of them have been conducted in hydroponic conditions (Montes Bayon *et al*. 2006).

Sunflower (*Helianthus annuus* L.) is an important oilseed crop. It occupies fourth place among oilseed crops in terms of acreage and production in India (Krishi Jagran, 2015). It is grown in an area of 0.73 m ha and has production of 0.52 million tonnes in India. Sunflower seeds are one of the incredible sources of health benefiting nutrients, minerals, antioxidants and vitamins. Sunflower seeds are rich in selenium having selenium about 79.3 µg in 100 g with a concentration of and ranks in top 10 foods containing selenium (USDA National Nutrient Database, 2014).

A pot experiment was conducted in an *Alfisol* of Rangareddy district, Telangana State during *rabi* of 2015 to study the performance of onion and sunflower under different sulphur and selenium treatments. The experiment was conducted in completely randomized design with four replications. Sixteen treatments were taken with combinations of four levels of soil applied sulphur (made at the beginning of the crop @ 0, 15, 30 and 45 kg S ha^{-1}) and four levels of foliar sprayed selenium given at 30th day of the crop (0, 25, 50 and 100 ppm Se).

Soil was air-dried at room temperature and was sieved using 2 mm sieve. Soil pH was measured using a pH meter (1:2.5 soil water suspension) and Electrical Conductivity was determined by Conductivity meter - Elico CM 180 (Jackson, 1973). Organic carbon was estimated using Chromic acid wet digestion method (Walkley and Black, 1934). Soil available N was determined using Alkaline potassium permanganate method (Subbiah and Asija, 1956), while available P_2O_5 was determined by Olsen's method using 0.5M $NaHCO_3$ (pH 8.5) extraction in ECIL GS 5701 SS colorimeter (Olsen *et al*. 1954). Soil available K_2O was determined by Neutral normal Ammonium acetate method (Mervin and Peech, 1951). Available Sulphur by Turbidometric method (Chesnin and Yien, 1950) and Total Selenium was determined by Azure B colorimetric method (Mathew and Narayana, 2006).

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Table 1. Initial characteristics of the Soil collected for the experiment

pH	EC (dS m^{-1})	OC(%)	Av. N (kg ha^{-1})	Av.P_2O_5 (kg ha^{-1})	Av.K_2O (kg ha^{-1})	Av. S (mg kg^{-1})	Total Se (mg kg^{-1})
7.75	0.29	0.66	188	58	286	9	2.71

It was observed that there was significant difference in bulb yield of onion and seed yield of sunflower due to application of sulphur. With the increase in sulphur levels from 0 to 45 kg S ha^{-1}, the bulb yield increased from 104 to 136 g pot^{-1}. The increase in bulb yield due to sulphur application ranged from 10 to 31 per cent. Similarly, there was significant difference in seed yield of sunflower crop due to various levels of sulphur application. The increase in yield of sunflower seed was more than 25 per cent over control.

It was found that the yield in both onion and sunflower increased with increasing sulphur application. Similar results were reported by Syed *et al*. (2006) in sunflower. They have reported that increase in sulphur levels from 0 to 60 kg ha^{-1} increased the seed yield from 8.14 to 10.04 q ha^{-1}. Shamima Nasreen and Imamul Huq (2002) also reported similar results in sunflower crop. They have reported that the seed yield increased from 1.80 to 3.68 t ha^{-1} with the application of sulphur @ 0 to 60 kg ha^{-1}.

Shamima Nasreen and Imamul Huq (2005) reported that onion bulb yield increased from 7.29 to 18.06 t/ha with increasing S levels from 0 to 60 kg ha^{-1}. Pradhan *et al*. (2015) found that application of sulphur (S) @ 45 kg ha^{-1} produced highest bulb yield of 251.10 q ha^{-1} followed by S @ 30 kg ha^{-1} (226.07 q ha^{-1}).

The bulb yield of onion increased with application of selenium up to 50 ppm. Subsequently, the weight decreased as foliar spray concentration was increased to 100 ppm. The sunflower seed yield increased from 4.46 to 5.65 g pot^{-1} with the increase in selenium levels from 0 to 50 ppm and then it decreased due to Se_{100} level of foliar spray. Thus, foliar sprays of selenium at 30 DAP/DAS enhanced the yield in both the crops upto 50 ppm but was not found to be beneficial at higher levels of foliar spray.

Petr Skarpa (2013) found that application of Se at 50 g ha^{-1}, increased the achenes yield by 3.1% while application of Se at 150 g ha^{-1}, decreased the yield by 6.8%.

Similar results were reported by Poldma Priit *et al.* (2013). They reported that the selenium spray treatment had a notable tendency to increase the yield in onion. On an average, spray @ 50 ppm significantly increased the bulb yield and weight of the bulb (3.6 kg m^{-2} and 81 g, respectively) compared to control (3.2 kg m^{-2} and 69 g respectively). The spray @ 100 ppm treatment had a tendency to decrease bulb weight (77 g) and yield (3.4 kg m^{-2}).

Hu *et al.* (2010) reported similar results in alfalfa where Se_{50} recorded highest yield of 1121 kg ha^{-1} compared to Se_0 treatment.

There was significant difference in bulb yield of onion crop due to interaction of sulphur and selenium levels. Bulb yield was highest with S_{45} x Se_{50} (149 g pot^{-1}) followed by S_{45} x Se_{25} (138 g pot^{-1}) and least in S_0 x Se_0 (101 g pot^{-1}) treatments, respectively. The bulb yield in S_{45} x Se_{50} is 7.38% higher when compared to S_{45} x Se_{25} treatment. There was significant difference in seed yield of sunflower crop also due to the same. Sunflower seed yield was highest in S_{45} x Se_{50} (7.41 g pot^{-1}) followed by S_{45} x Se_{25} (6.12 g pot^{-1}) and least in S_0 x Se_0 (3.45 g pot^{-1}) treatments, respectively. The seed yield in S_{45} x Se_{50} is 17.4% higher when compared to S_{45} x Se_{25} treatment.

In the interaction effect, it was found that with the increase in sulphur levels, yield also increased and with the increase in selenium levels, the yield increased till Se_{50} then decreased.

Table 2. Effect of sulphur and selenium on yield (g pot^{-1}) of Onion (bulb) and Sunflower (seed)

Se (ppm) / S(kg ha^{-1})	Onion (Fresh weight)					Sunflower				
	Se_0	Se_{25}	Se_{50}	Se_{100}	Mean	Se_0	Se_{25}	Se_{50}	Se_{100}	Mean
S_0	101	104	105	105	**104**	3.45	3.70	4.23	3.82	**3.80**
S_{15}	107	112	119	119	**114**	3.98	4.46	5.23	5.32	**4.75**
S_{30}	114	126	137	129	**127**	5.05	5.42	5.74	5.83	**5.51**
S_{45}	127	138	149	132	**136**	5.35	6.12	7.41	5.30	**6.04**
Mean	**112**	**120**	**128**	**121**		**4.46**	**4.93**	**5.65**	**5.07**	

Factors	Onion		Sunflower	
	SE(m)±	C.D at 5%	SE(m)±	C.D at 5%
Sulphur (S)	3.84	10.95	0.15	0.43
Selenium (Se)	3.84	10.95	0.15	0.43
S × Se	7.69	21.82	0.29	0.86

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Research note
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MARKETING OF COFFEE IN RWANDA – COSTS AND CHALLENGES

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Rwanda is a landlocked country situated in Central Africa. Also known as the land of a thousand hills, Rwanda has five volcanoes, twenty-three lakes and numerous rivers, some forming the source of the River Nile. The country lies 75 miles South of the equator in the Tropic of Capricorn, 880 miles West of the Indian ocean and 1,250 miles East of the Atlantic ocean - literally in the heart of Africa.

Coffee production in Rwanda dates back to 1904 with its first export occurring in 1917 (USAID, 2006). Since its introduction into Rwanda, coffee has played an important role in the economic development of the country and coffee growing is mainly a smallholder's activity. For many years, coffee has been the major source of foreign currency in Rwanda (MINAGRI, 2010).

Rwandan coffee is predominantly an export-oriented commodity, with over 95 per cent of the coffee produced in the country being exported, and the leftover locally consumed. Most of the Rwandan coffee is exported to European countries wherein 42 per cent of the coffee exported goes to Switzerland, 10 per cent to Belgium, 15 per cent to the United Kingdom, 19 per cent to America, 8 per cent to Uganda, 1 per cent to Kenya and the remaining 5 per cent goes to Asian countries and other importers.

The study used both primary and secondary sources to collect the relevant data. The primary data was collected from a sample of 60 coffee farmers and 20 coffee beans traders in Karongi and Rutsiro districts of Rwanda through a mailed questionnaire. Primary data with respect to coffee beans marketing and constraints faced by farmers and traders was collected. Secondary data relating to coffee production, export and prices from 2004 to 2014 was collected from National Agricultural Export Development Board – Rwanda and Ministry of Trade and Industry – Rwanda. Data was analysed using averages and percentages.

The study specifically aimed to understand the marketing pattern and the costs incurred in marketing of coffee in Rwanda and also the constraints faced by farmers and market intermediaries in marketing of coffee beans.

In marketing research, analysis of marketing cost is the most important aspect. Producer's profit largely depends on the various costs associated with the marketing of the produce. From the very entry in the market, farmers incur various kinds of costs which had a large impact on the gross returns. In the present study marketing costs incurred by the farmers and traders in coffee marketing channel were identified.

In the study area it was noticed that only one channel of marketing was prevalent for marketing of coffee beans.

In 2012, the farmers received low prices from traders in comparison with next three years. Gross price received by the coffee famers in coffee marketing channel was 702.5 rwf/ kg. Table 1 below indicates

Farmers ⟶ Traders ⟶ Exporters

that the total marketing costs incurred by farmers for coffee marketing in 2012 was 11.82 rwf/kg. The total marketing cost of coffee traders was 21.65 rwf/kg and gross price received by trader from exporter was 796.15 rwf/kg. It can be noticed that total cost incurred in marketing was 33.47 rwf/kg, which is 4.76 percent of the price received by the farmer. The traders' margin is 72 rwf/kg.

In 2013 the coffee farmers realised price of 756.67 rwf/kg which was higher than the coffee price of previous year, where farmers received 702.5 rwf/kg. Total costs of marketing by farmers in 2013

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was 13.61 rwf per kg. Traders got a gross price of 1,041.67 rwf/kg and incurred a total marketing cost of 21.79 rwf.kg.

A price of 820.69 rwf /kg of coffee beans was received by the farmers in the year of 2014 and the total marketing costs incurred by the farmers was 55.69 rwf/kg. For coffee traders the gross price received from exporters was 1470 rwf/kg with total marketing cost of 21.75 rwf/kg. The margin to the traders was 627.56 rwf/kg.

Among four years (from 2012 to 2015) analyzed, in the year 2015 farmers and traders received highest gross price/kg. Farmers selling in the coffee marketing channel received gross price of 842.5 rwf /kg. Gross price was quite high due to the pricing policy to provide farmers a better price and also because of high international coffee prices. Marketing costs incurred by the farmers in 2015 was 97.8 rwf/kg. Traders selling to the exporters received gross price of 1495 rwf/kg and spent a total marketing cost of 22.17 rwf/kg toward marketing of coffee beans.

The price received by the farmer increased by 19.93 per cent, where as the price received by traders increased by 87.78 per cent from 2012 to 2015. The margin of traders increased by 8.75 times during the period. It can be noticed that the price received by the farmers increased at very less rate compared to the price received by traders from exporters. Hence it can be said that the farmers have not benefited much over the period, where as the traders have benefited a lot.

Table 1. Marketing cost incurred by the Farmers and Traders (rwf/kg)

S. No	Particulars	2012	2013	2014	2015
1.	Gross price received by the farmer	702.5	756.67	820.69	842.5
2.	Marketing cost incurred by the farmer	11.82	13.61	55.69	97.8
3.	Total cost incurred by traders	21.65	21.79	21.75	22.17
4.	Trader selling price to exporter	796.15	1041.67	1470	1495

Source: Primary data

The coffee farmers and traders face different challenges in coffee production and marketing. With regard to the farmers, the most important problems were lack of choice in choosing a marketing channel, lack of current market information, lack of extension activity, low level of education, lack of credit, lack of roads and transportation and scattered living conditions of farmers. The major problems faced by coffee traders were the right of setting price, quantity and quality supplied by farmers, price fluctuation and access to credit followed by absence of storage facilities. (Table 2.)

Table 2. Constraints faced by coffee Farmers and Traders in Rwanda

S.No	Constraints	Most important	%	Important	%	Less important	%
	Constraints faced by Farmers						
1.	Lack of training	10	16.67	20	33.33	30	50.00
2.	Lack of road & transport	16	26.67	40	66.67	2	3.33
3.	Lack of current market information	2	3.33	55	91.67	3	5.00
4.	Lack of credit	7	11.67	6	10.00	47	78.33
5.	Lack of market channel	28	46.67	2	3.33	30	50.00
6.	Scattered living condition of farmers	3	5.00	50	83.33	7	11.67
7.	Poor post harvest handling	13	21.67	45	75.00	2	3.33

S.No	Constraints	Most important	%	Important	%	Less important	%
	Constraints faced by Farmers						
1.	Lack of training	10	16.67	20	33.33	30	50.00
2.	Lack of road & transport	16	26.67	40	66.67	2	3.33
3.	Lack of current market information	2	3.33	55	91.67	3	5.00
4.	Lack of credit	7	11.67	6	10.00	47	78.33
5.	Lack of market channel	28	46.67	2	3.33	30	50.00
6.	Scattered living condition of farmers	3	5.00	50	83.33	7	11.67
7.	Poor post harvest handling	13	21.67	45	75.00	2	3.33
8.	Lack of labor availability	16	26.67	20	33.33	24	40.00
	Constraints faced by Traders						
9.	Quality	10	50	3	15	7	35
10.	Quantity	8	40	10	50	2	10
11.	On time delivery	8	40	8	40	4	20
12.	Storage	11	55	5	25	4	20
13.	Price fluctuation	12	60	5	25	3	15
14.	Credit	7	35	9	45	4	20
15.	No right on price decision	13	65	4	20	3	15

Source : Primary data

It was found that there is only one coffee marketing channel in the country which is a barrier to the farmers and traders to decide the price because of lack of competition. Government should facilitate new investors to start new processing units that will provide final coffee products to consumers. This will raise number of coffee marketing channels.

Government should promote policies aimed at assisting the coffee farmers who live far from the coffee washing stations and market by providing roads and transport to facilitate access to these stations and markets.

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Research note
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CONSTRAINTS IN DAIRY FARMS IN KHAMMAM DISTRICT OF TELANGANA STATE

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Dairying in India, in general is closely interwoven as an integral part of agriculture and it has also been a source of livelihood of the weaker sections of rural community, especially the small and marginal farmers. In dairying a change that is taking place is shift from the non monetary inputs to monetary inputs, due to the decreasing size of land holdings and shrinking common property resources. The cost plays an important role in economic viability of a dairy enterprise. It is a critical economic indicator for milk producers, consumers and policy makers to provide an effective linkage between the milk producers and consumers for fixing the price of milk rationally. Generally, a milk producer can increase his dairy income in two ways viz., either by increasing the milk production or by reducing cost of milk production.

As per Economic Survey 2015-16, milk production in India has risen by a historic 6.25% to reach 146.3 million tonnes (MT) in 2014-15 against 137.7 MT in 2013-14, marginally higher than the target of 145.8 MT (Indiastat, 2015). This is the highest growth rate achieved in the past surpassing the previous high rate of 5.7% in 2006-07.

In India demand lead growth of milk production and increasing its supply is the only way to curb food inflation or the country to be self-sufficient (Lagos and Intodia, 2015) Working Group of the Planning Commission, Government of India 11thFive Year Plan in 2007 also had drawn attention to the need of enhancing growth rate in milk production and support overall growth of livestock and rural economy. Hence, this higher growth in milk production is in the direction of fulfilling the growing domestic demand for milk.

Dairying is recognized as an important source of income for small and marginal farmers in India, since on an average 22-26 per cent of the income of the rural households is contributed by milk. A large majority of milk producers have one or two milch animals and account for about 70 per cent of milk production. Low capital intensity, short operating cycle, steady returns make dairying a preferred livelihood activity among the small and marginal farmers. Lack of other lucrative and alternate employment opportunities in the villages often make dairying the only viable option for many villagers. It helps to improve the status of rural masses especially weaker sections, consisting of small and marginal farmers, landless labourers and women of low income families.

Telangana is blessed with rich livestock resources especially Cattle and Sheep population accounting to 5.52% of Country's population. The State stands 10th in Livestock population and 13th in Bovine population in the country. In Khammam the total Bovine population is 1161753, Cross bred cattle is 3, 977 and indigenous cattle is 2,45,171. About 29 Lakh families in Telanagana State are engaged in livestock sector for their livelihood. The value of livestock produce is estimated to be Rs. 30584 crores at current prices and Livestock contributes 7.1% to the Gross State Domestic Product and formed 39.69% of the Agriculture sector in 2014-15(Advance Estimates). The per capita availability is 234 gm/day in the state and has to catch up with the national average of 263 gm/day (2009-10). The State Government has sanctioned a cash incentive of Rs.4.00 per litre of milk to the Telangana Dairy farmers supplying milk to the State Dairy Federation, with a view to encourage the farmers, to increase their profits in area of dairy and to sustain their livelihood in the villages.

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The Government launched another innovative programme called "MANA VOORU - MANA PAADI PRANALIKA" by pooling resources, manpower and convergence of various Government Schemes. Initially 425 Milk Producers' Co-operative Societies are identiûed. The stree Nidhi Credit Co-operative Federation Ltd., has come forward for promotion of dairy activities in the State of Telangana by extending loans for purchase of milch animals with a condition that, the milk will be supplied to the Village Milk Collection Center (VMCC) of Telangana State Dairy Federation, without any interruption. All the initiatives taken up have resulted in increase of milk procurement in Telangana State from 1.27 Lakh litres per day (end of October i.e. before announcement of the incentive) to 2.01 Lakh litres per day as on 26-1-2015. In addition to this,Rashtriya Krishi Vikas Yojana (RKVY) is being implemented in the State, with central assistance to enhance the overall growth rate of 8% annually from livestock sector during the year 2014-15. Female Calf Feed Subsidy Programme ("Sunandini") is a continuous two year programme under the project. Elite female calves are enrolled under this project and Calf feed, health care and insurance were provided during 2013 -14 (1st year) and during the 2014-15 (2nd year). With the implementation of this project there is a considerable impact in reduction in Calf mortality, early maturity, replacement stock, increase in milk production and increase in income generation. (Livestock Census 2012). In view of the importance of dairy farming to marginal and small farmers the present study has been under taken to study the constraints of dairy farmers of marginal and small category, to suggest the strategies to be adopted for improving their livelihoods.

Cluster sampling technique is adopted for identification of three clusters which are mutually homogeneous but internally heterogeneous. Three clusters included three mandals of Khammam district i.e., Mudigonda, Kusumanchi, Nelakondapalli. In each cluster 15 small and 15 marginal farmers were randomly selected for the study who happened to grow different crops. Thus making a sample of 90 farmers under 45 marginal and 45 small farmers. Among the cluster mandals one village from each selected cluster with ensured heterogeneity. Where maximum numbers of dairy farmers under small and marginal category were there are selected.

The primary data required for economics of dairy farming adopted by small and marginal farmers will be obtained from the selected sample farmers by interview method through a pre-tested questionnaire. Garette ranking technique has been employed.

$$\frac{100\,(R_{ij} - 0.5)}{N}$$

Where,

R_{ij} = the ranking assigned to ith constraint by j^{th} respondent

N = No. of constraints

Major findings of the constraint analysis

Constraints in dairy farming faced by small and marginal farmers

Constraint analysis has been done from three perspectives namely technical, economic and infrastructural point of view. All the components of the categories of constraints were solved and Garrett scores were obtained and presented in tables 1, 2 and 3 respectively.

Technical constraints

The different technical constraints were analysed for both small and marginal farmers and outcome is projected in Table 1. Technical constraints listed are problem of disease attack, fluctuation of feed availability, low milk yield potential of local animals, inbreeding and non-availability of grazing lands at village level like common grazing lands.

When the overall sample is taken into consideration, major constraint experienced by the marginal farmers in case of technical aspect was in the order of non-availability of grazing lands in nearby locality (57.82), followed by low milk yield potential of animals (56.1), disease problem (51.8), inbreeding (51.71), more feed and care requirement of improved animals (46.41) and fluctuation of feed availability (41.67). In case of small farmers, the major constraint was low yield potential of animals (53.08), followed by non-availability of grazing lands in nearby locality (59.27), followed by and fluctuation of feed availability. Small farmers were are interested in rearing improved animals provided cost of their maintenance is affordable. The problems of low milk yield and non availability of grazing lands are two crucial things to

be addressed on priority. If the community based common grazing lands are taken care by spreading the perennial fodder seed and see that they survive, the cost of milk production will be reduced, and the green fodder consumption automatically enhances the milk yield *Ulmek and Patil (2001).*

Table 1. Technical constraints in Dairy farming

S. No	Technical constraints	Garrett Scores		
		Marginal	Small	Overall
1.	Low milk yield potential of local animals	56.1(2)	53.08(2)	54.34(2)
2.	Non-availability of grazing lands in nearby locality	57.82(1)	59.27(1)	55.06(1)
3.	Fluctuation of feed availability	41.67(6)	53.84(3)	47.5(5)
4.	Disease problem	51.84(3)	52.15(4)	51.9(3)
5.	Inbreeding	51.71(4)	46.24(5)	48.6(4)
6.	More feed and more care requirement of improved animals	46.41(5)	43.11(6)	44.67(6)

Economic constraints

Table 2 presents different economic constraints as perceived by sample dairy farmers. The economic constraints are those impediments pertaining to the cost items and expenditure involved in maintaining dairy animals.

Economic constraints include lack of capital, high cost of feed, high purchase value of improved animals, higher cost of veterinary medicine charges and labour problem.

When the average of both marginal and small farmers are considered, the higher cost of veterinary medicines was the most economic constraint (54.62) for marginal farmers followed by non- availability of family labour (50.55) as a result of nuclear family system and lack of capital (37.2). In case of small farmers, high purchase value of improved animals (43.88), followed by higher cost of veterinary medicines (43.14) and non-availability of family labour (42.77) are the major constraints.

The economic constraints posed by the two groups seemed alike. This envisages credit support for improved animals and reduction in the cost of veterinary drugs. Lalwani and Koshta (2001).

Table 2. Economic constraints in Dairy farming

S. No	Economic Constraints	Garrett Scores		
		Marginal	Small	Overall
1.	Lack of capital	37.2(3)	37.6(5)	39.87(3)
2.	High cost of feed	33.51(4)	40.92(4)	39.75(4)
3.	High purchase value of improved animals	31.66(5)	43.88(1)	39.79(5)
4.	Higher cost of veterinary medicines	54.62(1)	43.14(2)	51.98(1)
5.	Non-availability of family labour	50.55(2)	42.77(3)	49.98(2)

Infrastructural constraints

Infrastructural constraints in dairy as perceived by the dairy farmers are presented in Table.3.

Infrastructural constraints include inadequate veterinary service centres, absence of market network for green fodder and unavailability of bull of superior trait and A.I. The major constraint faced by marginal

farmers are inadequate veterinary service centres (57.24), followed by unavailability of bull of superior trait and A.I network (47.82) and absence of market network for green fodder (44.92). In case of small farmers, unavailability of bull of superior trait (60.37) found to be major constraint followed by absence of market network for green fodder (51.42) and inadequate veterinary services (38.1) respectively.

Inadequate veterinary service provided to the dairy farmers was also reported to be one of the important constraints in dairy management. In most of the cases the services that were rendered by veterinary technicians were observed to be insufficient, may be due to lack of skilled technicians or due to lack of the required medicines, etc. Therefore, skilled veterinary technicians and veterinary dispensaries should be made available to the dairy farmers at village level to make the dairy sector productive and competent Banerjee and Yadav. (2003)

Table 3. Infrastructural constraints in Dairy farming

S. No	Infrastructural constraints	Garrett Scores		
		Marginal	Small	Overall
1.	Inadequate veterinary services	57.24(1)	38.1(3)	39.87(3)
2.	Absence of market network for green fodder	44.92(3)	51.48(2)	39.75(4)
3.	Unavailability of bull of superior trait and A.I network	47.82(2)	60.37(1)	39.79(5)

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Research note
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IMPACT OF FACILITATIVE COUNSELING SESSIONS ON PSYCHOSOCIAL PROBLEMS FACED BY YOUNG ADULT WOMEN

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Facilitative Counseling is a learning oriented process, carried on a simple one to one social environment, in which the counselor professionally competent in psychological skills and knowledge seeks to assist the client by methods appropriate to the latter's needs and within the context of the total personal programme. Counseling techniques involve active listening, emphatic understanding, releasing the pent up feelings confronting the client and so on Counseling therefore is offered to only those individuals who are under serious problem and need professional help to overcome it (Jacobs 1994 and Biswalo 1996). The goal of facilitative counseling is to help individuals overcome many of their future problems. Naturally counseling has to minister to a variety of problems, such as educational, vocational, marital, parental and personal. The major objective of all counseling is to help individuals become self-sufficient, self-dependent, self-directed and to adjust themselves efficiently to the demands of a better and meaningful life (Burks and Steffire, 1979).

Sample size: A total of 30 young adult women with psychosocial problems formed the sample of the study.

Tools: Interview schedule was developed to collect general profile of the young adult women Self-developed five point rating continuum was developed to study the psychosocial problems of the young adult women before and after facilitative counseling.

Problems experienced: The psychosocial problems that are perceived by the young adult women include physical, emotional, educational, family, social, cognitive, financial, career and problem solving skills.

Table 1. Impact of Counseling on Psychosocial Problems faced by young adult women

S.No	Psychosocial Problem domains	Before counseling		After counseling		t value	P value
		Mean	SD	Mean	SD		
1.	Physical	42.3	3.5	12.1	1.5	43.3	0.001**
2.	Emotional	40.7	2.4	13.3	2.2	46.09	0.001**
3.	Educational	35.1	3.08	16.4	3.1	23.4	0.001**
4.	Family	38.2	2.5	10.8	2.7	40.78	0.001**
5.	Social	38.9	3.4	11.7	1.89	38.29	0.001**
6.	Cognitive	41.8	3.56	13.2	2.67	35.2	0.001**
7.	Financial	29.1	3.7	8.43	3.7	21.6	0.001**
8.	Career	25.8	2.9	7.8	1.5	30.1	0.001**
9.	Problem solving	36.7	4.1	14.02	2.9	24.73	0.001**

**p<0.01 level of significance

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The impact of facilitative counseling on psychosocial problems perceived by the young adult women in experimental group was presented in the table 1. From this it could be inferred that in physical domain problems before counseling the mean score was 42.3 suggesting that respondents had more physical problems but after counseling the mean was 12.1 with p value .001 (<0.01) significant differences in physical problems was found. In emotional domain area before counseling the mean score was 40.7 and after counseling it was 13.3 and p value .001 shows a significant impact of counseling in reducing the emotional problems. In educational domain the mean was 35.1 initially but after facilitative counseling sessions the mean was 16.4 which were found to be significant. In other problem areas like family, social, cognitive, financial, career and problem solving the mean score before counseling was found to be more. After counseling of CBT the mean scores of respondents in these domains decreased. The p values in all the psychosocial problem domains showed a significant difference in problem areas between pre-test and post-test scores.

From this it was concluded that young adult women in experimental group had higher level of problems in physical, emotional, educational, social, family, cognitive, financial, career and problem solving areas. After the CBT cognitive behavior therapy the psychosocial problems of the young women decreased and statistically significant difference was found between pre and post counseling.

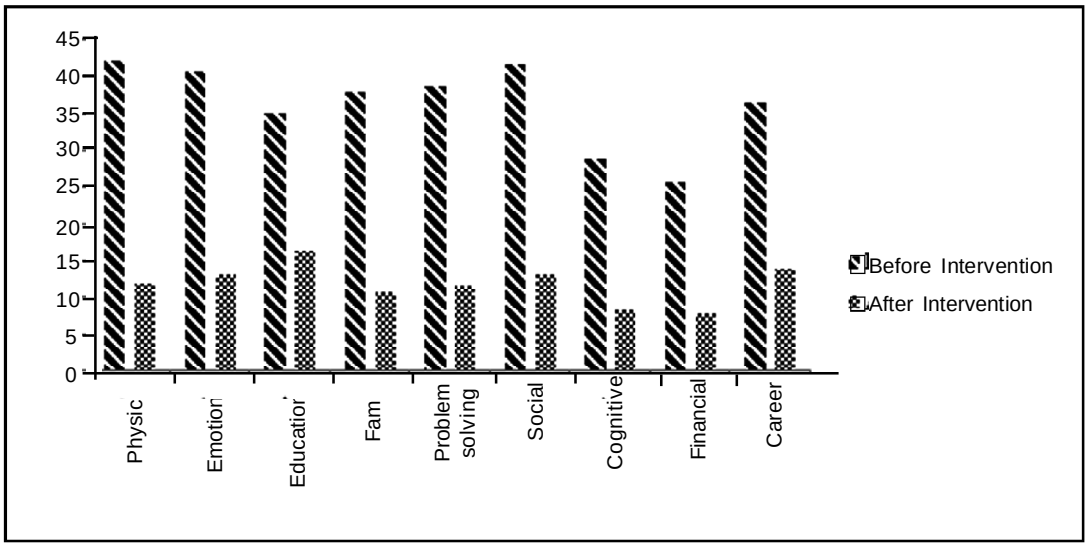

Fig 1: Psychosocial problems of young adult women in experimental group before and after counseling

Table 2. Mean differences in Psychosocial problem domains between experimental and control after counseling

S.No	Psychosocial Problem domains	Experimental Group		Control Group		t value	P value
		Mean	SD	Mean	SD		
1.	Physical	12.1	1.5	43.2	3.7	42.6	0.001**
2.	Emotional	13.3	2.2	38.4	3.2	35.4	0.001**
3.	Educational	16.4	3.1	36.7	2.9	26.19	0.001**
4.	Family	10.8	2.7	35.5	1.09	46.6	0.001**
5.	Social	11.7	1.89	34.3	3.2	33.3	0.001**
6.	Cognitive	13.2	2.67	40.92	1.86	46.6	0.001**
7.	Financial	8.43	3.7	27.3	3.4	20.56	0.001**
8.	Career	7.8	1.5	25.9	1.34	49.2	0.001**
9.	Problem solving	14.02	2.9	37.3	2.5	33.3	0.001**

The differences in psychosocial problems between experimental and control group after counseling was presented in the table. The results of the study conclude that the mean score of experimental group in physical problems was 12.1 whereas the mean score of control group 43.2, p value of 0.001 indicated a significant difference between experimental and control group. In emotional domain the mean score of experimental group was 13.3 and control group 38.4 with p value >0.01 a significant difference was found between them. In educational domain the mean score was 16.4 for experimental and 36.7 for control a significant difference statistically was found between the two groups. In Family problems the experimental group scored mean of 10.8 while control group was 35.5, with p value 0.001 statistically significant difference was found between the two groups. In social and cognitive areas the mean score of experimental group was 11.7 and 13.2 respectively while that of control group was 34.3 and 40.9 p value of 0.001 a statistically significant difference was found. The mean scores of experimental group in financial, career and problem solving skills was lower than that of control group after counseling. The p value in all these areas was significant statistically as it was less than 0.01.

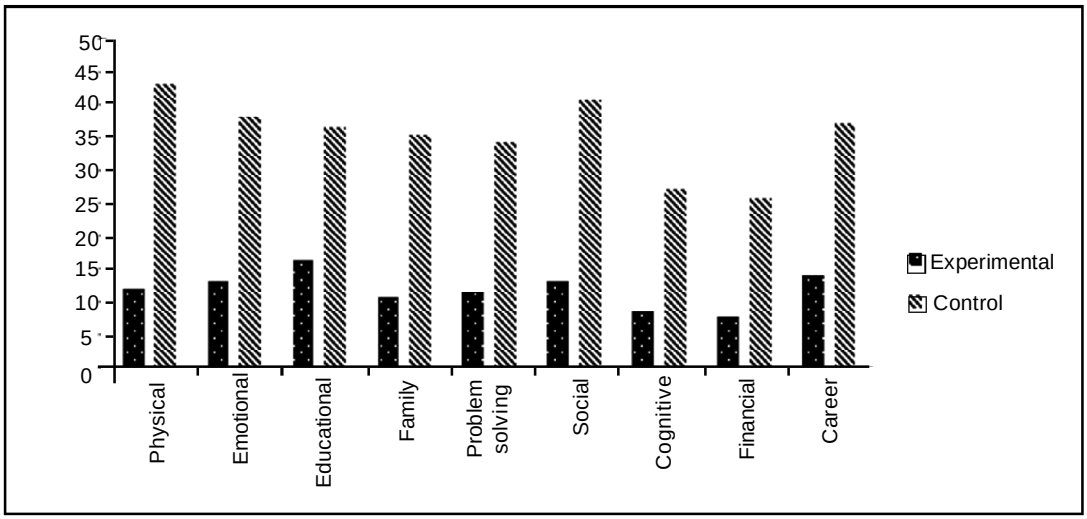

Fig: 2 Psychosocial problems of experimental and control group after counseling

The study concludes that young adult women in experimental and control group had problems with family, career, education, emotion, social, and cognition, physical, financial and problem solving areas. The experimental group received facilitative counseling while the control group didn't receive any. After the counseling sessions both the groups were tested for the psychosocial problems and it was found that the experimental group that received counseling reduced psychosocial problems in all the domain areas, but the control group which was not subjected to any kind of counseling the psychosocial problem remained the same. Hence it could be said that counseling had an impact on psychosocial problem.

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DEVELOPMENT AND SENSORY EVALUATION OF IRON FORTIFIED RTE (READY TO EAT) EXTRUDED SNACK

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Iron is essential for a wide range of functions in the human body. In addition to its major functions in oxygen transport and as a cofactor in many enzymes, iron also plays an important role in the immune system. Although the mechanisms involved are complex, there is good evidence that an abnormal iron nutritional status can lead to impaired immune function, with serious consequences for health (Allen *et al*. 2006).

Iron deficiency ultimately results in microcytic hypochromic anaemia, or simply, as iron deficiency anaemia (IDA). Iron deficiency anemia, is a worldwide problem affecting about 2 billion individuals (Stoltzfus*.,* 2008). Iron deficiency has become a major global health problem that was ranked 7th among the preventable risks for disease, disability and death by World Health Organization (WHO, 2004). Food fortification is being recognized as a sustainable, relatively simple and realistic way to reduce and prevent iron deficiency (Hurrell, 2002 and De Romaña *et al.* 2002). The WHO/ FAO (2006), recommends that the order of priority for iron compounds used for fortification should be ferrous sulphate, ferrous fumarate, encapsulated ferrous sulphate/fumarate, electrolytic iron at twice the dose of ferrous sulphate/ fumarate, ferric pyrophosphate at twice the dose of ferrous sulphate/fumarate and NaFeEDTA for high-phytate cereal flours.

In the last ten years, changes in life-style and eating patterns have led to a gradual increase in demand for snack foods. Consumers want snacks that taste good and smell good, feel good, look good and in addition, nutritionally superior and healthy. Extrusion cooking is one of the contemporary food processing technologies applied for preparation of a variety of snacks, specialty and supplementary foods hence extrusion cooking technology could be the best method of producing the RTE snack fortified with iron (Riaz 2006).

Raw materials required for product development namely sorghum flour, corn flour, rice flour and roasted bengal gram flour were procured from the local market in Hyderabad. Three sources of iron (dried ferrous sulphate, ferrous fumarate and electrolytic elemental iron powder) for fortification of the RTE extruded snack were procured from the certified suppliers in Mumbai and Pune. Laboratory model co-rotating twin screw extruder (Scientech Engineers, Calcutta, India) was used for development of the extrudates. Different formulations were extruded at 85±5 (heater I) and 110±5 (heater II) temperature, 300 rm^{-1} screw speed, 100±10 die temperature, 3mm exit diameter of circular die and 15±2 kgh^{-1} feed rate.

The extruded snacks made from sorghum, rice, corn and roasted bengal gram dhal (50:20:20:10) was selected for fortification (1/4th and 1/6th RDA of iron by considering 30mg/day as target). Formulations used for sensory evaluation are presented in Table 1. After extrusion, the extrudates were dried for 10 min at 60p C and cooled to have better crispness in final extruded product.

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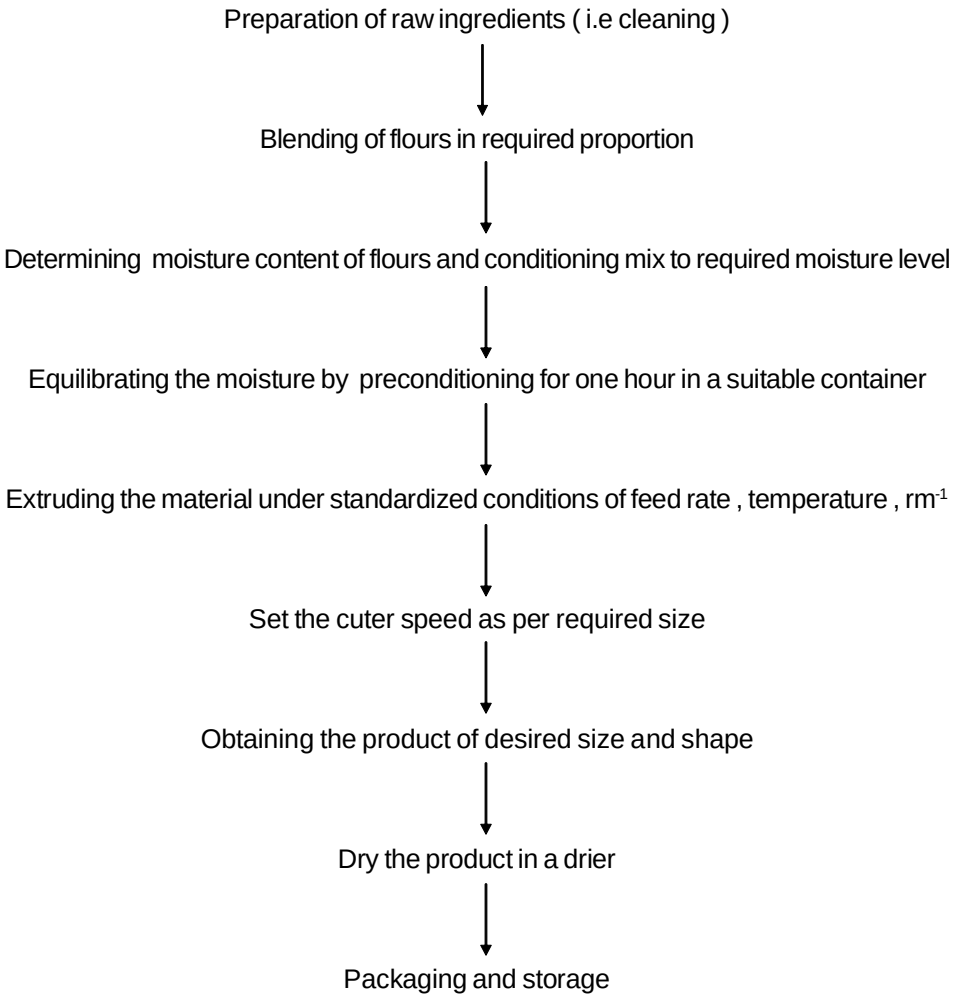
Table 1. Formulations used for Sensory evaluation

T1	S.F+C.F+R.F+R.B.G.F	50:20:20:10
T2	S.F+C.F+R.F+R.B.G.F+F.S/7.5mg	50:20:20:10+7.5mg
T3	S.F+C.F+R.F+R.B.G.F+F.F/7.5mg	50:20:20:10+7.5mg
T4	S.F+C.F+R.F+R.B.G.F+E.I/7.5mg	50:20:20:10+7.5mg
T5	S.F+C.F+R.F+R.B.G.F+F.S/5mg	50:20:20:10+5mg
T6	S.F+C.F+R.F+R.B.G.F+F.F/5mg	50:20:20:10+5mg
T7	S.F+C.F+R.F+R.B.G.F+E.I/5mg	50:20:20:10+5mg

Note : S.F=Sorghum Flour, C.F=Corn Flour, R.F= Rice Flour, R.B.G.F=Roasted Bengal Gram flour. F.S= Ferrous Sulphate, F.F= Ferrous Fumarate, E.I= Elemental Iron.

Product development: Steps followed for extrusion process is detailed below



The cost of developed extruded product was calculated based on the cost of raw material and overhead cost. From the cost analysis, it was observed that the product cost ranged from Rs.11.61 to Rs.11.63 per 100g of the product. The cost of the control sample was almost equal to fortified snacks indicating that, addition of iron compounds did not affect cost of the product, but found nutritionally superior than control sample.

Sensory evaluation of extruded snacks using five point headonic scale was carried out at lab level to know the best acceptable product among different combinations by using semi trained panel of judges. Extrudates without fortification was served as a control. The mean scores of sensory evaluation are given in table 2.

Table 2. Mean scores of Sensory evaluation

Treatments	Color	Texture	Taste	Flavor	Overall acceptability
T1	4.73 ± 0.45^{d}	4.07 ± 0.64^{c}	3.80 ± 0.61^{b}	3.83 ± 0.75^{b}	4.12 ± 0.72^{c}
T2	2.20 ± 0.89^{a}	2.67 ± 0.88^{a}	2.47 ± 1.14^{a}	2.50 ± 0.97^{a}	2.68 ± 0.90^{a}
T3	3.90 ± 0.66^{c}	4.00 ± 0.83^{c}	3.80 ± 0.96^{b}	3.70 ± 0.92^{b}	3.87 ± 0.82^{b}
T4	3.07 ± 0.83^{b}	3.77 ± 0.86^{c}	3.50 ± 0.90^{b}	3.60 ± 0.72^{b}	3.60 ± 0.86^{b}
T5	2.33 ± 0.99^{a}	3.13 ± 1.14^{b}	2.50 ± 1.01^{a}	2.70 ± 0.95^{a}	2.77 ± 1.10^{a}
T6	3.87 ± 0.63^{c}	4.10 ± 0.71^{c}	3.63 ± 0.76^{b}	3.67 ± 0.76^{b}	3.77 ± 0.77^{b}
T7	3.33 ± 0.88^{b}	3.97 ± 0.81^{c}	3.60 ± 0.97^{b}	3.43 ± 0.90^{b}	3.55 ± 1.00^{b}
CD at 5%	0.40	0.43	0.47	0.43	0.45
F-value	40.25*	12.72*	12.19*	11.34*	11.37*

Note : Values are expressed as mean±SD. Mean values with similar superscripts within a column do not differ significantly (P>0.05). *-signifcant at 5% level. NS-Not Significant.

All the extrudates scored well for color except the sample with ferrous sulphate (2.33±0.99) which was little darker in color. Control (T1) sample scored higher for color (4.73±0.45) compared to other iron fortified samples. Addition of iron altered the product original color leading to slight darkness compared with the control sample.

Extrudates made from ferrous sulphate (T5) had least score (3.13±1.14) for the texture attribute. Highest score (4.07±0.64) was observed for control sample (T1) followed by product made from ferrous fumarate (T3) (4.00±0.83) and elemental iron (T4) (3.77±0.86). Textural properties were good for all the extrudates except ferrous sulphate , which was found to be little harder due to less expansion.

Taste of all the extrudates were found to be good except ferrous sulphate fortified products (T2 & T5) which had metallic after taste. The mean scores ranged from 2.47±1.14 to 3.80±0.61. Highest score was observed for control sample (T1) and least for ferrous sulphate RTE extrudates (T2). Regarding flavor, the sample fortified with ferrous sulphate (T2) had a metallic after taste which lead to lower acceptability. Mean scores for overall acceptability of the extrudates of the control sample was high (4.12±0.72), followed by sample with ferrous fumarate (3.87±0.82), elemental iron (3.60±0.86) and ferrous sulphate (2.77±1.10).

Sensory evaluation of the extruded samples at lab level showed that the control sample scored high in all sensory attributes (colour, taste, flavor, texture and overall acceptability) when compared to experimental samples fortified with iron. Addition of various iron sources did have an effect on the sensory attributes. Among the experimental extrudates, the most accepted was extrudates fortified with ferrous fumarate (T3) followed by elemental iron (T4) and ferrous sulphate (T5) fortified extrudates. Compared

to all the extruded samples, ferrous sulphate fortified extrudates had low acceptability because of its after taste and dark color.

The results of this study showed that incorporation of ferrous fumarate and elemental iron can be effectively used to produce RTE extruded snacks by extrusion cooking. Addition of iron in the RTE extruded snack improved the nutrient content of the snacks without affecting the cost of the product. The use of ingredients like ferrous fumarate and elemental iron powder in an RTE snack product could make a great contribution to food security in developing countries.

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A STUDY ON THE MARKET PERFORMANCE OF DAIRY PRODUCTS OF DIFFERENT BRANDS IN HYDERABAD

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India ranks first in milk production, accounting for 18.5% of world production with a total production of 155.5 Mt during 2015-16 and with a per-capita availability of 337 g/day (NDDB, 2017). About 46% of the total milk produced is consumed in liquid form while another 47% is converted into traditional products like cottage butter, ghee, paneer, khova, curd, malai etc. The remaining seven per cent of the milk goes into the production of western style products like milk powders, processed butter and processed cheese (Singh, 2008).

Total milk production in Telangana was 2.06 Mt during 2015-16. Hyderabad the metro city in the State alone consumes 25 lakh litres of milk daily, of which 18 lakh litres supplied through organized sector and the rest by individual milk men. About 12 lakh litres supplied by major brands which include Vijaya, Vijaya Telangana, Heritage, Amul, Jersey and others. Besides liquid milk they supply milk products such as ghee, butter, flavoured milk doodh peda etc. Since several brands co-exist in the city it would be interesting to study performance and analyze the brand preference across dairy product range (Reddy, 2010).

A survey was conducted in Hyderabad city in 6 (six) densely populated sectors, In these areas viz. Malakpet, Kukatpally, Abids, Musheerabad, Ramgopalpet and Charminar consumer and dealer survey was done. From each of these selected areas, 20 consumers and 5 dealers handling different brands were interviewed. Thus, a total of 120 consumers and 30 dealers were selected for the study.

Primary data regarding consumption pattern, perception about the socio-economic status, perception about the brand, purchase behavior were collected from consumers.

Similarly information on turn over, preferences, dealers margins were collected from dealers by using structured pre-tested interview schedule. The secondary data were collected from research papers, books, journals, websites, companies and dealers' records etc. The data so collected were analyzed to ascertain the preferences, dominance and overall performance of various brands in the Hyderabad urban market. Vijaya Telangana brand (3.8) ghee has the highest preference in the market. Heritage is the highest margin provider (4.0) to the dealers and highly profitable brand. Amul butter and doodh peda (3.25) is highly preferred. In case of flavored milk most preferable brands are Vijaya Telangana (3.6) and Jersey (3.6).

Consumer's Perception about the various brands of Milk Products

Consumer's preferences to purchase various brands of Milk Products

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Table 1. Factors Influencing consumers in purchasing the particular Milk Product

S.No	Factors	Ghee	Butter	Doodh peda	Flavored milk
1	Advertising	2.75	3.3	1.3	3.5
2	Brand name	4	4.5	1.5	3.8
3	Quality	4.6	4.3	4.8	4.6
4	Price	4.3	4.6	4.5	4.25
5	Taste	4.08	4.0	4.3	4.5
6	Availability	1.3	1.6	3.6	3.41
7	Discounts handling by the company	3.41	2	3.0	2.9
8	Complaints handling	3.58	1.6	1.25	1.25
9	Free gifts and offers	1.16	2.8	4.08	1.35

The main factors influencing most of the respondents to purchase ghee in Hyderabad are quality (4.6), price (4.3) and the factor influencing the least is free gifts and offers (1.16). For butter Price (4.6) and brand name (4.5) are major factors with availability (1.6) and complaints handling were the least important factors. With respect to doodh peda major factors influencing purchase are quality (4.8), price (4.5) and complaints handling (1.25) is the least important. In case of flavored milk main factors impacting consumer buying decision are quality (4.6), taste (4.5) and the least influencer is complaint handling (1.25).

Table 2. The Brands of Milk Products purchased by consumers

S.No	Brand	Products	Average Score
1	Vijaya	Ghee	3
		Butter	1.5
		Doodh peda	1.3
		Flavored milk	2.8
2	Vijaya Telangana	Ghee	3.8
		Butter	3.0
		Doodh peda	1.66
		Flavored milk	3.5
3	Jersey	Ghee	2.4
		Butter	3
		Doodh peda	2.16
		Flavored milk	3.58
4	Amul	Ghee	3.0
		Butter	3.75
		Doodh peda	3.25
		Flavored milk	1.16
5	Heritage	Ghee	3.5
		Butter	3
		Doodh peda	1.83
		Flavored milk	3.29
6	Others	Ghee	3.83
		Butter	2.3
		Doodh peda	1.25
		Flavored milk	1.16

Table 3. Rating of various Milk Products on various parameters

Company Brand	Product	Price	Product quantity	Considerable quantity	Flavour	Taste	Product distribution	Free gifts and offers
Vijaya	Ghee	4.1	3	2.7	4.0	4.1	1.2	1.1
	Butter	2.4	1.1	2.5	3.3	4.6	1.8	3.5
	Doodh peda	1.1	2.6	4	3.6	2.4	2.2	3.3
	Flavored milk	4.5	3.8	4.2	4.2	4.1	2.2	1.2
Vijaya Telangana	Ghee	4.5	4.8	4	4.5	4.2	1.7	1.1
	Butter	3.3	3.6	2.8	3.2	4.3	2.0	1.8
	Doodh peda	3.2	3.6	1.1	4.6	3.0	1.8	2
	Flavored milk	4.0	4.8	3.5	4	4.9	4.0	2.3
Jersey	Ghee	4.0	3.3	3.3	3.8	4	4.7	1.1
	Butter	3.5	3.7	2.7	2.3	3	4.6	3.7
	Doodh peda	4.0	2.9	3.3	3	2.8	4.5	4.3
	Flavored milk	3.3	3.0	4	3.3	2.3	3.5	3.5
Amul	Ghee	4.3	3.8	4.2	4	3.2	4	1.6
	Butter	3	5.0	3	3.3	4.1	4.0	1.8
	Doodh peda	3	4.1	3.9	3.7	4.3	3.3	1.6
	Flavored milk	4.1	4.3	4.2	4	3.9	2.5	1.6
Heritage	Ghee	4.2	4.6	3.3	5	4	4.1	1.2
	Butter	3.3	4.1	3.1	4.1	4.0	4.2	1.5
	Doodh peda	3.1	3.7	3.0	3.3	4.3	2.0	1.6
	Flavored milk	3.3	4.1	4	3.5	4.1	4.1	2.0
Others	Ghee	4.8	4.8	3.3	3.5	4	3.5	2.3
	Butter	1.6	2.0	2.1	2.4	2.5	2.9	3.3
	Doodh peda	3.0	4.3	3.2	3.1	3.3	3.4	3.3
	Flavored milk	3.2	4.2	3.1	3.2	3.3	2.3	2.3

For ghee the highest preference rating was given to Vijaya Telangana brand (3.8), Heritage (3.5) and the least preference to Jersey (2.4) on a scale of 1-5, with 5 being the highest rank. In case of Butter most preferable brands are Amul (3.75), Vijaya Telangana (3.0) and Heritage (3.0). With respect to doodh peda highly preferable brand is Amul (3.25) and Jersey (2.16) is the next choice and the least preferred brand is Vijaya (1.5). In case of flavored milk most preferable brands were Vijaya Telangana (3.6) and Jersey (3.6). Next to them Heritage is preferable (3.25), least preference is given to other competitors (1.16).

Rating of Various Milk Product brands based on various parameters

Vijaya – most of the respondents rated that Vijaya ghee is good based on parameters like price (4.1), flavour (4.08) and taste (4.1). In case of Vijaya brand butter most of the consumer respondents felt that the taste (4.6) was good, while in respect of doodh peda the quantity (4.0) was felt to be good. In case of flavored milk price (4.5), quantity (4.25), flavour (4.25), taste (4.0) performance is good. Product distribution is poor in case of all the four milk products.

Vijaya Telangana – respondents rated that Vijaya Telangana as excellent in Quality (4.8), price (4.5), flavour (4.5) and good at taste (4.2) but very poor in distribution (1.75).Similarly for the product -butter taste was rated as good (4.3), average on Price (3.3), quality (3.6), quantity (2.8), flavour (3.25), and poor in product distribution (2.0) and free gifts and offers (1.8). Vijaya- Telangana brand doodh peda flavour (4.6) was rated excellent, average in terms of price (3.2), quality (3.6) and taste (3.0) but poor in quantity (1.1) and product distribution (1.8). On the other hand for the flavored milk quality (4.8), taste (4.9) was rated excellent, good at price (4.0), flavour (4.0) and product distribution (3.0).

According the respondents rating the Jersey-brand ghee is good at price (4.0), taste (4.0), excellent in product distribution (4.75), average in quality (3.3) and quantity (3.3). Butter is excellent in product distribution (4.6) but remains average in price (3.5), quality (3.75), quantity (3.0), taste (3.0) and poor in flavour (2.3). Doodh peda is excellent in product distribution (4.5), good at price (4.0), gifts and offers (4.3), average in quality (2.9), quantity (3.3), flavour (3.0) and taste (2.8). Flavored milk is good at quantity (4.0), average in quality (3.0), flavour (3.0) and taste (2.8). Flavored milk is good at quantity (4.0), average at price (3.3), quality (3.6), and distribution (3.5).

Amul - ghee is good at price (4.0), quantity (4.25), flavour (4.0), product distribution (4.0), average in quality (3.83), taste (3.25). Butter is excellent in product quality (5.0), good in taste (4.1), product distribution (4.0), average at price (3.0) and quantity (3.0). Flavored milk is good at price (4.1), quality (4.3), quantity (4.25), flavour (4.0), and taste (3.9) but poor in distribution (2.5).

Factors Influencing Dealer's Perceptions on various Milk Product brands

Table 4. Dealers Rating of various brands of Milk Products

S.No	Brand	Margins	Profitability	Demand	Quality	Credit availability	Stock returns	Timely Supply
1	Vijaya	2.6	3.6	3	3.8	1	1	2.3
2	Vijaya Telangana	3.1	3.8	4	4	1	1	2.0
3	Jersey	3	3.4	3.6	3	1	1	4
4	Amul	3.3	3.7	4	4	1	1	3.6
5	Heritage	4	4	4	3.3	1	1	3.8
6	Others	3	3.6	2.3	2.8	1	1	3.1

Heritage is providing an excellent margin (4.0) to the dealers whereas Vijaya Telangana (3.1), Jersey (3.0), Amul (3.3) and others (3.0) were relatively good in margins. Among all the brands Heritage products have been rated as highly profitable (4.0) followed by brands like Vijaya Telangana (3.8), Jersey (3.4), Amul (3.7) and others (3.6). Demand for Vijaya Telangana (4.0), Amul (4.0) and Heritage (4.0) milk products is high. Vijaya Telangana and Amul are excellent in quality i.e. (4.0). Jersey is excellent in timely supply (4.0) and Heritage (3.8) is second excellent. For all the brands credit availability (1) and stock returns (1) are poor.

Table 5. Factors Influencing the Dealers in Preferring particular brand

S.No	Factor	Average score	Garrett rank
1	Timely supply	66.26	1
2	Stock returns policy	41	5
3	Higher margins	65.7	2
4	Credit period	39.7	7
5	Credit amount	40.7	6
6	Brand value	58.8	3
7	Promotional activities of the company (discounts, offers etc.)	42.8	4

The major factor influencing the dealers is Timely supply with the score 66.26 (rank 1) and next factor is higher margins with the score 65.7 (rank 2). The factor influencing the least with dealers in preferring a brand is credit period (rank 7).

The factors influencing consumers in the purchase decision of the milk products shows that the quality, price, taste, flavour, brand name were most important and availability and complaints handling are least important parameters which influences the consumers in their purchase decision. With regard to the dealers the timely supply is an important factor for majority of the dealers followed by margins.

For ghee the highest preference was given to Vijaya Telangana brand and Heritage. In case of Butter most preferable brand is Amul. With respect to doodh peda highly preferable brand is Amul. In case of flavored milk most preferable brands are Vijaya Telangana and Jersey.

Consumer perception clearly indicated that Vijaya Telangana attracted excellent rating for the factors like quality, price and flavour for its products ghee and flavored milk. Similarly, Heritage always received the top rating (excellent) for ghee in terms of flavour. Amul butter is rated excellent in quality. Jersey obtained excellent rating for their product distribution.

Dealer's perception clearly indicated that Vijaya Telangana is the highest in ghee sales and turnover and Overall turnover of the milk products. Heritage is the highest margin provider to the dealers and highly profitable brand. Amul is the highest in butter sales and turnover (Ramanjaneyalu, N. 2012).

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IMPACT OF NATIONAL AGRICULTURAL INSURANCE SCHEME (NAIS) ON RICE FARMING IN MAHABOOBNAGAR DISTRICT OF TELANGANA

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The idea of crop insurance in India was conceptualized as far back as 1920, when S. Chakravarti proposed an agricultural insurance scheme based on rainfall approach (Vyas and Singh, 2006). In 1979, with the recommendations of Dhandekar Committee, the General Insurance Corporation implemented the Pilot Crop Insurance Scheme based on homogenous area approach. Following this, another scheme called 'Comprehensive Crop Insurance Scheme (CCIS)' was implemented in 1985. This scheme was further modified and implemented throughout the country as National Agricultural Insurance Scheme (NAIS) in 1999. Agriculture Insurance Company of India Ltd. (AICL) has been managing and implementing this crop insurance scheme in India since April 2003. Unlike earlier insurance schemes which were restricted to the loanee farmers only, NAIS is available to both loanee and non-loanee farmers. Against this background it was felt that there is need to study the impact of NAIS. Further, it is presumed that there would be significant difference in productivity and input use on rice farms.

Mahaboobnagar district of Telangana state was purposively selected for the present study as this region receives low rainfall and is mostly drought prone. It has also remained on the forefront in deriving benefits of National Agricultural Insurance Scheme (NAIS) in Telangana state. The present study was based entirely on primary data which was collected from both insured and non-insured farmers i.e, 60 each thus 120 total sample farmers. The primary data regarding input use and cost of cultivation was collected through survey method by interviewing both the insured and non insured farmers using specially designed pre-tested schedule. Simple averages and percentages were used to arrive valid results and conclusions.

Input utilization on Paddy crop grown by sample farmers

A comparative picture of input-use among insured and non-insured paddy farms revealed that, input utilization on insured paddy farms was more than that on non-insured paddy farms. It was observed from Table 1 that on an average the utilization of inputs like human labour, machine power, seed, fertilizers and plant protection chemicals were found to be higher on insured paddy farms than non-insured paddy farms as they were assured of protection through insurance. These results were in conformity with Vikram Singh Rathore *et al.* (2011) that use of inputs such as human and bullock labour, seed, manures, fertilizers, pesticides, etc. has been found significantly higher on insured farms than on non-insured farms.

Table1. Input use level of sample farmers on insured and non-insured Paddy farms per hectare.

S.No	Particulars	Insured	Non-Insured
1	Human labour (Man days)	74.6	70.7
2	Machine power (Hours)	10.0	9.9
3	Seed (Kg)	62.5	56.3
4	Green manures (*Crotalaria juncea* L seed in Kg)	42.5	36.9
5	Fertilizers (Kg)	566.5	526.1
6	Plant protection chemicals (litres)	2.7	1.5

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Cost of cultivation of Paddy on sample insured and non-insured farms

The profitability of any enterprise depends upon costs and returns. Usually, in any economic study, the total costs are discussed under two heads, *viz*., variable costs and fixed costs. In general, variable costs alone are reckoned to be the cost of cultivation by farming community ignoring the fixed costs. In economic analysis of any business enterprise, fixed costs are also taken into account to arrive at total costs and compute profits. Variable costs include expenses on labour employed to perform different cultural practices and also expenses incurred on material inputs such as seeds, manures, green leaf manures, fertilizers, plant protection chemicals etc. and it also includes interest on working capital. The fixed costs are depreciation on working assets, interest on fixed capital, land revenue, rent on owned land etc.

On an average, the total cost of cultivation per hectare on paddy farms of insured and non-insured farmers were ₹ 71570.9 and 68051.8 respectively. The break-up of the total costs into variable and fixed costs indicated that the variable costs were 43335.5 (60.55%) and 40929.8 (60.15%), while the fixed costs were 28235.3 (39.45%) and 27122.0 (39.85%) on insured and non-insured paddy farms respectively.

The glance at Table 2 reveals that, out of total cost incurred in the cultivation of paddy by insured farmers, the variable costs contributed about 43335.5 (60.55%) out of which machine power contributed about 15454.2 (21.59%), followed by human labour 11899.6 (16.63%) and fertilizers 7616.7 (10.64%). Expenditure on seeds, green manure, plant protection chemicals and miscellaneous costs were 2615.8 (3.65%), 2200.0 (3.07%), 1694.9 (2.37%) and 915.8 (1.28%) respectively. Interest on working capital was 938.3 (1.31%). Fixed costs constitute about 28235.3 (39.45%) of the total cost. Rental value of owned land constitute about 25208.3 (35.22%) and remaining is constituted by land revenue, depreciation on implements and farm buildings and interest on fixed capital which constitute about 100.0 (0.14%), 1177.1 (1.64%) and 1749.9 (2.45%) respectively.

In case of non-insured farmers the variable costs constitute about 40929.8 (60.15%) out of which machine power contributed about 15441.7 (22.69%), followed by human labour 11199.1 (16.46%) and fertilizers 7036.6 (10.34%). Expenditure on seeds, green manure, plant protection chemicals and miscellaneous costs were 2346.6 (3.45%), 1280.7 (1.88%) and 835.7 (1.23%) respectively. Interest on working capital was 882.4 (1.30%). Fixed costs constitute about 27122.0 (39.85%) of the total cost. Rental value of owned land constitute about 25041.6 (36.80%) and remaining is constituted by land revenue, depreciation on implements and farm buildings and interest on fixed capital which constitute about 100.0 (0.15%), 391.2 (0.57%) and 1589.1 (2.34%) respectively.

The above results revealed that the cost of cultivation of paddy was found to be higher on sample insured farms than non-insured farms. The average variable cost, average fixed cost and total cost were all found higher on insured farms than non-insured farms. This shows that the insured farmers had invested more on hired labour, machine labour, manures, fertilizers, plant protection chemicals than non-insured farmers.

Cost of cultivation of Paddy farms according to cost concepts

It was noticed from Table 3 that commercial cost of cultivation (Cost C) was higher on insured paddy farms 71570.9 as compared to non-insured paddy farms 68051.8. Cost B also followed the same trend being higher on insured farms when compared with non-insured farms. The higher value of cost A_1, on insured paddy farms 40195.4 than on non-insured paddy farms 37642.2 was due to more expenditure on green manure seed, fertilizers and plant protection chemicals.

Table 2. Cost of cultivation of Paddy farms of insured and non-insured farmers (in ₹/ ha)

S.No	Particulars	Insured farms		Non - Insured farms	
		Amount (₹/ ha)	Per cent (%)	Amount (₹/ ha)	Per cent (%)
I	**Variable cost**				
1.	Human labour	11899.6	16.63	11199.1	16.46
2.	Bullock labour	0.0	0.00	0.0	0.00
3.	Machine power	15454.2	21.59	15441.7	22.69
4.	Seed	2615.8	3.65	2346.6	3.45
5.	Green manure	2200.0	3.07	1906.6	2.80
6.	Fertilizers	7616.7	10.64	7036.6	10.34
7.	Plant protection chemicals	1694.9	2.37	1280.7	1.88
8.	Transportation and other miscellaneous costs	915.8	1.28	835.7	1.23
9.	Interest on working capital @ 7%	938.3	1.31	882.4	1.30
	Subtotal of Variable costs (I)	43335.5	60.55	40929.8	60.15
II	**Fixed costs**				
10.	Land revenue	100.0	0.14	100.0	0.15
11.	Rental value of owned land	25208.3	35.22	25041.6	36.80
12.	Depreciation	1177.1	1.64	391.2	0.57
13.	Interest on fixed capital @10%	1749.9	2.45	1589.1	2.34
	Subtotal of Fixed costs (II)	28235.3	39.45	27122.0	39.85
	Total cost of cultivation (I+II)	71570.9	100.0	68051.8	100.0

Table 3. Cost of cultivation of Paddy farms according to cost concepts

S.No	Cost concepts	Insured farm (₹/ ha)	Non - Insured farm (₹/ ha)
1	Cost A_1	40195.4	37642.2
2	Cost A_2	40195.4	37642.2
3	Cost B	67153.7	64231.3
4	Cost C	71570..9	68051.8
5	Cost of production (₹/ qtl)	1076.7	1149.5

Cost B was also higher owing to higher rental value of the owned land and interest on fixed capital. The variation between Cost B and Cost C on insured and non-insured paddy farms could be attributed to imputed value of family labour. The cost of production of insured paddy was worked out to be ₹ 1076.7 per quintal as compared to non- insured paddy i.e., 1149.5 per quintal on paddy farms. With above information we could conclude that commercial cost of cultivation (Cost C) was higher on insured paddy farms compared to non insured paddy farms. This is because of higher expenditure on critical inputs like seed, fertilizers,

etc.by insured farmers as they were assured of compensation when crop fails due to natural disasters.

Farm income measures of selected Paddy farms of sample farmers

The details of physical output and returns per hectare realized by sample farmers from insured and non-insured paddy cultivation are presented in Table 4. On an average, the yield of main product per hectare was 66.4 and 59.2 quintals on insured and non-insured paddy farms respectively. The selected insured and non-insured paddy farmers realized an average gross income of 96280.0 and 85840.0 per hectare respectively. The gross income was more by 10440.0 on insured paddy farms over non-insured paddy farms. The net income was higher on insured paddy farms (24709.1) when compared to non-insured paddy farms (17788.2). This makes it obvious that the insured paddy farms were very efficient in paddy production compared to non-insured paddy farms.

Farm business income is a measure which indicates the returns for owned resources like land, labour and capital. It was 56084.6 and 48197.8 on insured and non-insured paddy farms respectively. Insured paddy farmers derived more family labour income amounting to 29126.3 as against 21608.7 by non- insured farmers. Farm investment income is a measure which indicates the returns to fixed capital. It was 51667.4 and 44377.3 per hectare on insured and non- insured paddy farms respectively. Insured paddy farmers were able to secure 1.34 per every rupee of expenditure while non-insured paddy farmers realized 1.26.

Table 4. Farm income measures of selected Paddy farms of sample farmers (₹/ha)

S.No	Cost concepts	Insured farm	Non-Insured farm
1	Yield (q/ha)	66.4	59.2
2	Market price (₹/q)	1450.0	1450.0
3	Gross return	96280.0	85840.0
4	Total cost	71570.9	68051.8
5	Net return	24709.1	17788.2
6	Return per rupee spent	1.34	1.26
7	Farm business income	56084.6	48197.8
8	Family labour income	29126.3	21608.7
9	Farm investment income	51667.4	44377.3

These results were in confirmity with Jayakumara Vardhan and Kumar (2012) that crop insurance scheme has led to the use of high value inputs like seed fertilizers and plant protection chemicals. The insured farmers have realized more returns than their non insured counterparts.

The study has found that net income is higher on insured paddy farms than non-insured paddy farms. Use of inputs like human and bullock labour, seed, manures, fertilizers, pesticides, etc. was higher on insured farms than on non-insured paddy farms. With the above results we conclude that insured farmers have invested more on hired human, machine and bullock labour, seeds, manures, fertilizers, plant protection chemicals, etc. than non-insured farmers mainly because of guaranteed compensation from NAIS.

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PROBLEMS IN PRODUCTION AND MARKETING OF POMEGRANATE (*Punica granatum*) – A CASE OF AFGHANISTAN FARMERS

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Pomegranate production is a significant contributor to the Afghans agricultural economy. Pomegranate is a major fruit crop in many provinces such as Kandahar, Helmand, Wardak, Ghazni, Paktia, Farah, Kapisa and Balkh, and is the source of the livelihood for thousands of people. Afghanistan is known as "The country of the pomegranate fruit" in view of not only its conventional methods of cultivation but also for the quality of the landraces grown. Some leading botanists believe that Afghanistan is the cradle of world pomegranate production. Afghanistan has more varieties of pomegranate trees than anywhere else in the world. Since 1970s, political turm oil and wars have ravaged the country; this had a serious effect on exporting the fruit to its biggest markets in Pakistan and India. (Sadiq, 2010)

Pomegranates contribute about 2 per cent to the total horticultural production in Afghanistan. The local varieties grown in the main production area of Kandahar province are known for their high quality and productivity. Farmers reported average yields ranging from about 1,900 Kg/jerib (9,600 Kg/hectare) in Dand district to more than 2,000 Kg/jeribes(10,000 Kg/ hectare) in Arghandab district. Farah Province is also well known for pomegranate production and the high quality of its fruits. In these two districts, pomegranate is the second most cultivated fruit crop. Total production of pomegranate in Afghanistan is 75,000 tons per year, which produce 3 per cent of pomegranates of the world. (Wahab, 2008)

Different varieties of pomegranates are produced in Afghanistan and supplied to the local markets. Though the maturity time of the crop varies according to the climatic conditions, usually the fruit comes into the market during summer and continues into the fall season. The quantity supplied increases during the fall and relatively the price decreases. Since cold storage facilities are not available for the farmers to store them and keep them for a longer time, farmers are forced to sell them as soon as possible. A large portion of the pomegranates are exported to nearest markets due to availability of transportation. (Rabani, 2013).

In view of the above, this study was carried out to examine the problems faced by the farmers in production and marketing of pomegranate in Afghanistan.

There are 18 districts in Kandahar province, of which 2 districts predominately grow pomegranate Viz., Arghandab and Dand and therefore were purposively selected. From each district, four villages Viz., Shikhchala, Mirabkhoran, Dehkhashak and Gulkalacha from Arghandab district and Mianji, Roohabad, Khushab and Qazi Kariz villages from Dand district were selected. From each village, 15 farmers growing pomegranate were identified for the study. Therefore a total of 120 pomegranate group farmers formed the basis of the study. Similarly 30 traders from both the selected districts were interviewed to gather the information about the problems faced by them in marketing. Rank Based Quotient (RBQ) was used to identify the constraints / problems faced by the farmers in the production and in marketing of pomegranate cultivation. The quantification of data was done by first ranking the constraints based on the responses obtained and then calculating the Rank Based Quotient (RBQ)

Which is as follows :

$$R.B.Q = \frac{\sum fi(n+1-i)}{N x n}$$

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Where,

Fi = Number of respondents reporting a particular factor under i^{th} rank

N = Total number of respondents

n = number of factors identified

Problems in Pomegranate production in Arghandab and Dand districts

In order to know the problems with regard to the pomegranate production, the selected farmers were advised to rank 6 listed problems in accordance with the level of importance.

Table 1. Problems in production of pomegranate in Arghandab and Dand districts

Problems	Arghandab		Dand	
	R.B.Q Score	Rank	R.B.Q Score	Rank
Non availability of good planting material	69.7	II	62.7	IV
Non availability of technical guidance	64.7	IV	64	III
Non availability of appropriate pesticide	65.4	III	60.4	V
Non availability of labour	42.5	V	44.5	VI
Poor irrigation facilities	33.9	VI	76.5	II
Limited capital	82.8	I	79.5	I

(Source: Survey data, 2016)

From the analysis, it is clearly seen that the limited capital was ranked as the most important problem, since without sufficient capital, the production of pomegranate was being affected. Therefore capital is the vital factor in the production process (R.B.Q score 82.8). The second important problem was non-availability of good planting material (R.B.Q score 69.7), followed by non-availability of appropriate pesticide (R.B.Q score 65.4). The other problems were non-availability of technical guidance for the farmers (R.B.Q score 64.7), non-availability of labour during the season (R.B.Q score 42.5), and poor irrigation facilities which was ranked as the sixth problem (R.B.Q score 33.9) in Arghandab district.

Similarly in Dand district, limited capital was identified as the most important problem with (R.B.Q score 79.5), whereas poor irrigation facilities was ranked second (R.B.Q score 76.5), as the area depends on bore well irrigation and there is shortage of water and electricity. Availability of technical guidance and non-availability of technical guidance is ranked as third and fourth important problems respectively whereas non-availability of appropriate pesticides and non-availability of labour were allotted fifth and sixth ranks.

Problems in marketing of pomegranate in Arghandab and Dand district

Table 2. Problems in marketing of pomegranate in Arghandab and Dand district

Problems	Arghandab		Dand	
	R.B.Q Score	Rank	R.B.Q Score	Rank
Lack of proper storage	60.7	VI	61.8	VII
Lack of information	60.1	VII	64.2	VI
Poor infrastructure	58.8	VIII	60.9	VIII
Poor transport facilities	48.3	X	54.6	X
Frequent price fluctuations	67.8	III	67.8	II
Limited local market	67.1	IV	64.4	V

Problems	Arghandab		Dand	
	R.B.Q Score	Rank	R.B.Q Score	Rank
Lack of quality certification	56.4	IX	60.3	IX
Lack of financial support	75.2	I	73.8	I
Lack of Govt support	68.4	II	66.5	III
Problems of taxation	64.8	V	65.8	IV

Source: Survey data, 2016)

The results of the analysis of the problems of marketing are presented in the Table 2. Lack of financial support to the farmers and traders (Wholesalers and retailers) has been identified as the most important problem of marketing of pomegranates (R.B.Q score 75.2). Farmers and traders have ranked the problem of poor government support as second with (R.B.Q score 68.4). Closer to the problem of government support, is the problem of frequent price fluctuations and is ranked third by the farmers and traders with R.B.Q score 67.8, limited local market sales, problem of taxation, lack of proper storage facilities, lack of information on demand, supply and prices were ranked in sequence of importance with the R.B.Q score 67.1, 64.8 and 60.1 respect. Lack of quality certification facility (R.B.Q score 56.4) was ranked ninth and poor transport facility (R.B.Q score 48.3) is tenth problem in marketing of pomegranate.

Thus it can be inferred that financial support, government support, price fluctuation as the most important problems in Arghandab district.

Similarly in Dand district, lack of financial support to the farmers and traders (Wholesalers and retailers) has been identified as the most important problem of marketing of pomegranates (R.B.Q score 73.8). Farmers and traders have ranked the problem of price fluctuation as second with R.B.Q score of 67.8. closer to the problem of frequent price fluctuate, is the problem of government support and is ranked third by the farmers and traders with R.B.Q score of 66.5. Problem of taxation, Limited local market sales, lack of information on demand, supply and prices, lack of proper storage facilities were ranked in sequence of importance with the R.B.Q score of 65.8, 64.2, 61.8 respectively. Lack of quality certification facility (R.B.Q score 60.3) was ranked ninth and poor transport facility (R.B.Q score 54.6) as tenth problem in marketing of pomegranate. Thus it can be inferred that lack of financial support, price fluctuation, and negligible government support as the most important problems in Dand district. (Rane and Bagade, 2008).

Therefore, it is suggested that the government should extend support both technical and financial to the farmers which will improve the productivity and the farmers can also receive a better price. Further, strengthening of market information system by providing timely and reliable indicators about the market conditions (arrivals, price etc) will result in proper scheduling of their supplies into the market. Access to quality planting materials and good storage facilities will improve the profitability of Afghan farmers.

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PERFORMANCE EVALUATION OF CO–OPERATIVE SOCIETIES IN KARIMNAGAR DISTRICT - A COMPARATIVE STUDY

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Credit is occupying an important place in the strategy for development of agriculture. Credit is a critical input that affects agricultural and rural productivity along with the other inputs. Credit is important enough to establish causality with productivity. Indian farmers are unable to meet their increased capital needs out of funds generated on the farm (Calkins and Ngo, 2005). Due to inadequate financial resources and absence of timely credit facilities at reasonable rates, many of the farmers, even though willing, are unable to go in for improved package of practices or to introduce better methods in agriculture The agricultural credit system of India consists of informal and formal sources of credit supply. The informal sources like commission agents, traders, private money lenders etc. are major channels for distribution. Formal credit in India includes commercial banks, cooperatives and micro-finance institutions (Carla and Dohmwirth, 2014).

Karimnagar district was purposively selected, as it is one of the most progressive districts in Telangana state with the maximum number of cooperatives. Among the cooperatives, Mulkanoor Cooperative Society in Bheemadevarapally Mandal is playing a very significant role in providing credit through borrowings and its own savings. With the availability of adequate financial facilities, majority of the farmer members are inclined to go in for investments in agriculture. The society is extending its operation in 14 villages in the mandal.

Apart from Mulkanoor Cooperative Society another Primary Agricultural Credit Society located in Katkoor village in the same mandal is also catering credit needs of the farmers in three villages.

Organizational structure and operation of the selected Cooperative Societies

The Mulkanoor Cooperative Society was registered on 27th of July 1956 under Hyderabad Cooperative Societies Act 1952. Later the society has been reregistered under Andhra Pradesh Mutually Aided Cooperative Societies Act 1995. The society is Asia's biggest Cooperative institution in the rural agricultural sector. Primary objectives of the society is to provide timely finance with subsidiary rate of interest, to increase production and returns, to stop migration of farmers to other areas in search of work and to eliminate money lenders and middle men from the market. The society has been rendering services to its members benefitting them more than a government can do and emerged as a potential and successful competitor with private sector in the area of agricultural credit, input supply and marketing.

Primary Agricultural Cooperative Credit Society (PACS) – Katkoor was established in 1958 under the Cooperative Credit Societies Act of 1904. Primary objectives of the society is to provide credit and inputs to the farmers, to provide marketing facilities for the sale of agricultural produce and to associate itself with economic and social welfare programmes of the village.

To study the performance of the selected cooperative societies, data on membership, share capital, credits, deposits and profits were collected from the annual reports of the societies and growth rate were calculated to know the performance of the selected cooperative societies. The results are presented below.

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Growth of Membership in selected Cooperative Societies

The Mulkanoor Cooperative Society was started with a primary membership of 373 and membership has increased to 7547 in 2014-15. The area of operation of the society is spread over 14 villages of Bheemadevarapally mandal of Karimnagar district. Whereas the total membership in the Primary Agricultural Cooperative credit Societies (PACS) – Katkoor was 1886 and the society is extending its operations in three villages of Bheemadevarapally mandal in Karimnagar district.

The details pertaining to growth of membership in selected cooperative societies has been presented in the Table 1. The table reveals that, the total membership in Mulkanoor Cooperative Society has increased by 21.68 per cent from 6202 (2005-06) to 7547 (2014-15) with an annual growth rate of 2.34 per cent. During the same period in PACS - Katkoor, total membership has increased by 10.68 per cent from 1704 (2005-06) to 1886 (2014-15) with an annual growth rate of 1.30 per cent. Growth in membership was found to be high in Mulkanoor Cooperative Society compared to PACS – Katkoor.

Table 1. Growth of Membership in selected Cooperative Societies

(In number)

S. No	Year	Total membership in Mulkanoor Cooperative Society	Total membership in PACS – Katkoor
1	2005-06	6202	1704
2	2006-07	6251(0.79)	1724(1.17)
3	2007-08	6410(3.35)	1738(1.99)
4	2008-09	6934(11.8)	1734(1.76)
5	2009-10	7246(16.83)	1750(2.19)
6	2010-11	7356(18.6)	1836(7.74)
7	2011-12	7349(18.49)	1844(8.21)
8	2012-13	7432(19.83)	1879(10.27)
9	2013-14	7462(20.31)	1882(10.44)
10	2014-15	7547(21.68)	1886(10.68)
	Mean	7018.9	1797.7
	S.D	532.81	73.96
	C.V	7.59	4.11
	Growth rate	2.34	1.30

Source: Data compiled from annual reports of the societies

Figures in parenthesis indicates percentage increase over the base year 2005-06

Growth in Share capital of selected Cooperative Societies

Members share capital represents individual member's commitment to the cooperative form of business. The Mulkanoor Cooperative Society was started with an authorized share capital of Rs. 2300. Since then it has been enhanced to 11 crores as on 31st March, 2015. Members initial share capital is Rs. 100 at the time of admission and 5 per cent of the loan amount will be collected as share capital each time of loaning subjected to a maximum of Rs. 50000 (500 shares). In PACS – Katkoor, members join with an

initial share capital of Rs. 300 at the time of admission and 10 per cent of loan will be collected as share capital at each time of loaning. The total share capital of PACS – Katkoor was 17 lakhs as on 31st March, 2015.

The details pertaining to growth of share capital in selected cooperative societies has been presented in the Table 2. The table reveals that, the share capital of Mulkanoor Cooperative Society has increased from 238.05 lakhs (2005-06) to 1170.45 lakhs (2014-15) with an annual growth rate of 16.79 per cent. During the same period in PACS - Katkoor, share capital has increased from 3.88 lakhs (2005-06) to 17.12 lakhs (2014-15) with an annual growth rate of 19.88 per cent. Though there is an increase in share capital of both the societies, in absolute terms, share capital of Mulkanoor Cooperative Society was found to be high compared to PACS – Katkoor.

Table 2. Growth of Share capital in selected Cooperative Societies

(Rs. in lakhs)

S. No	Year	Share capital of Mulkanoor Cooperative Society	Share capital of PACS – Katkoor
1	2005-06	238.05	3.88
2	2006-07	280.01(17.62)	3.07(-20.88)
3	2007-08	344.23(44.6)	3.17(-18.3)
4	2008-09	420.37(76.58)	3.11(5.92)
5	2009-10	482.76(102.79)	6.56(69.07)
6	2010-11	584.9(145.7)	10.34(166.49)
7	2011-12	719.5(202.24)	10.76(177.31)
8	2012-13	814.88(242.31)	14.29(268.29)
9	2013-14	1000.23(320.17)	15.31(294.58)
10	2014-15	1170.45(391.68)	17.12(341.23)
	Mean	605.53	8.66
	S.D	314.6	5.62
	C.V	51.95	64.94
	Growth rate	16.79	19.88

Source: Data compiled from annual reports of the societies

Figures in parenthesis indicates percentage increase over the base year 2005-06

Trends in deposits of selected Cooperative Society

The total deposits of society in Mulkanoor Cooperative Society includes all kind of deposits are accepted from members and non – members. The society is paying 9 per cent interest on deposits which is one per cent higher than the interest rate offered by nationalized banks. No such facility is available in PACS – Katkoor. The Mulkanoor Cooperative Society though having adequate capital base of own sources, it borrows credit from SBH, Mulkanoor and National Cooperative Development Corporation (NCDC) to provide timely credit to its members and to develop infrastructural facilities like godowns etc. PACS – Katkoor do not have adequate capital of own source to provide loans to its members. It borrows credit from the District Central Cooperative Bank (DCCB) Karimnagar.

Table 3. Trend in deposits of selected Cooperative Societies

(Rs. In lakhs)

S. No	Year	Mulkanoor Cooperative Society	PACS – Katkoor
1	2010-11	13005.24	101.65
2	2011-12	15064.73(15.83)	101.28(-0.36)
3	2012-13	16395.03(26.06)	138.84(36.58)
4	2013-14	18539.53(42.55)	126.46(24.4)
5	2014-15	20876.59(60.52)	128.69(26.6)
	Mean	16776.22	119.38
	Growth rate	11.45	6.63

Source: Data compiled from annual report of PACS – Katkoor
Figures in parenthesis indicates percentage increase over the base year 2010-11

The details pertaining to growth in deposits of the selected cooperative societies have been presented in the Table 3. Total deposits in Mulkanoor cooperative society has been increased by 60.52 per cent from 13005.24 lakhs in 2010-11 to 20876.59 lakhs in 2014-15 with an annual growth rate of 11.45 per cent. In case of PACS – Katkoor, total deposits has been increased by 26.6 per cent from 24.45 lakhs in 2010-11 to 19.68 lakhs in 2014-15 with an annual growth rate 6.63 per cent. Growth in total deposits was found to be high in Mulkanoor Cooperative Society compared to PACS – Katkoor.

Profits of the selected Cooperative Societies

Profit is a reward for risk-taken in the business. Profit is necessary for the survival and growth of societies. Profit is a yard stick that tests the efficiency of the firm. Profits can be used to meet future

Table 4. Growth in profits of selected Cooperative Societies

(Rs. In lakhs)

S. No	Years	Mulkanoor Cooperative Society			PACS – Katkoor		
		Income	Expenditure	Profit	Income	Expenditure	Profits
1	2010-11	1753.96	1528.80	225.16	10.56	4.66	5.9
2	2011-12	1846.35	1576.96	269.39 (19.64)	9.23	5.72	3.51(-40.51)
3	2012-13	2014.87	1708.28	306.59(36.16)	3.12	2.19	0.93(-84.25)
4	2013-14	2277.63	1881.10	396.53(76.11)	15.58	9.42	6.16(4.4)
5	2014-15	2294.45	1906.46	387.99(72.31)	13.54	8.96	4.58(-22.38)
	Mean			317.13			4.21
	Growth rate			14.27			0.023

Source: Data compiled from annual report of selected cooperative societies
Figures in parenthesis indicates percentage increase over the base year 2010-11

contingencies. The success of the society can be judged by extent of profit earning capacity.

Details of the profits gained by the selected cooperative societies have been presented in the Table 4. Profits of the Mulkanoor Cooperative Society have shown increasing trend where as PACS - Katkoor profits has shown fluctuating trend. Profits of Mulkanoor Cooperative Society have grown by 72.31 per cent from 225.16 lakhs in 2010-11 to 387.99 lakhs in 2014-15 with an annual growth rate of 14.27 per cent. Whereas profits of PACS - Katkoor has been decreased by -22.38 per cent from 5.9 lakhs in 2010-11 to 4.58 lakhs in 2014-15 with an annual growth rate of 0.023 per cent. The growth rate of profits in Mulkanoor Cooperative Society was found to be high compared to PACS – Katkoor.

Membership and share capital growth has been observed in both the societies. But growth rate was found to be more in Mulkanoor Cooperative Society than PACS – Katkoor.Growth in profits was observed to be high in Mulkanoor Cooperative Society compared to PACS – Katkoor.

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Research note
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CHILDREN'S ACCEPTABILITY OF MID DAY MEAL (MDM) SUPPLIED FROM CENTRALIZED KITCHEN - AKSHAYA PATRA IN MEDAK DISTRICT

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Malnutrition adversely affects Universalization of Elementary Education (UEE). Even if a malnourished child does attend school, he/she finds it difficult to concentrate on and participate in the learning activities in school. To combat classroom hunger and promoting better learning, school meals has been realized as an important means of protecting children's right to food.

In November 2001, an interim order of the Supreme Court of India directed that cooked meals must be provided in all government and government-aided primary schools by converting the provision of a midday meal into a legal entitlement for all school-going children.The Government of India introduced a revised Mid Day Meal Scheme (MDMS) in 2006, increasing the calorie content of the meal to 450k.calories (from 300k.calories) and protein to 12g (from 8-12g).

Mid Day Meal scheme has many benefits such as increasing enrolment and attendance in schools, especially of girl children, and addressing the issue of classroom hunger, thereby increasing learning ability (Drèze and Goyal 2003). The MDMS also has large socialization and educational benefits. However, studies have also found that there is still a lot to be achieved as far as the quality of the midday meal is concerned. For instance, in many places the same menu is given every day (usually Roti or Rice and a watery Dal or Sambar) with no vegetables, eggs, fruits and so on (Khera, 2006).

Sen (2005) reported that MDM has made positive intervention in universalisation of Primary Education by increasing enrolment, attendance of the children. Mathur (2014) revealed that Cooked Mid Day meal has reduced classroom hunger especially those belonging to underprivileged sections. Cooked mid day meal has also contributed to the cause of social equity as children, cutting across caste and class lines sit together to share a common meal.

Mallik (2008) conducted a study to find out the best practices in the implementation of MDM Scheme in Orissa and found that providing eggs twice in a week (Wednesday and Friday), serving rice and dal along with the mixed vegetables twice or thrice a week and serving homemade pickle to the children during lunch hour were some good and acceptable practices in MDM.

Sahoo (2014) in a study reported that taste and smell of the food need to be improved but the appearance and texture were quite appropriate. All the students were satisfied with MDM program and there was no significant association between student's satisfaction level and the demographic variables.

There is a lot of difference in the acceptability of MDM in schools, more so in places where the food supplies are from a centralized kitchen.In view of the above, the study was planned with an objective toassess the children's acceptability of MDM from Akshaya Patra Centralized Kitchen of Medak district with kitchen located at Patancheru mandal. One hundred and fifty children studying Class I to Class VIII from 3 Mandals namely Pothireddypally, Sadashivpet and Hathnur were selected for the study.

Children's acceptance of MDM was elicited through an opinion questionnaire, developed by the researcher. Preparations like Khichdi, Rice and Dal, Rice and Sambar, Vegetable pulao, Tamarind rice, Fried rice, Jeera rice were the major alternative meals served to the children, while fruits or Chikki or Tilladoo or mixture were served as snack.

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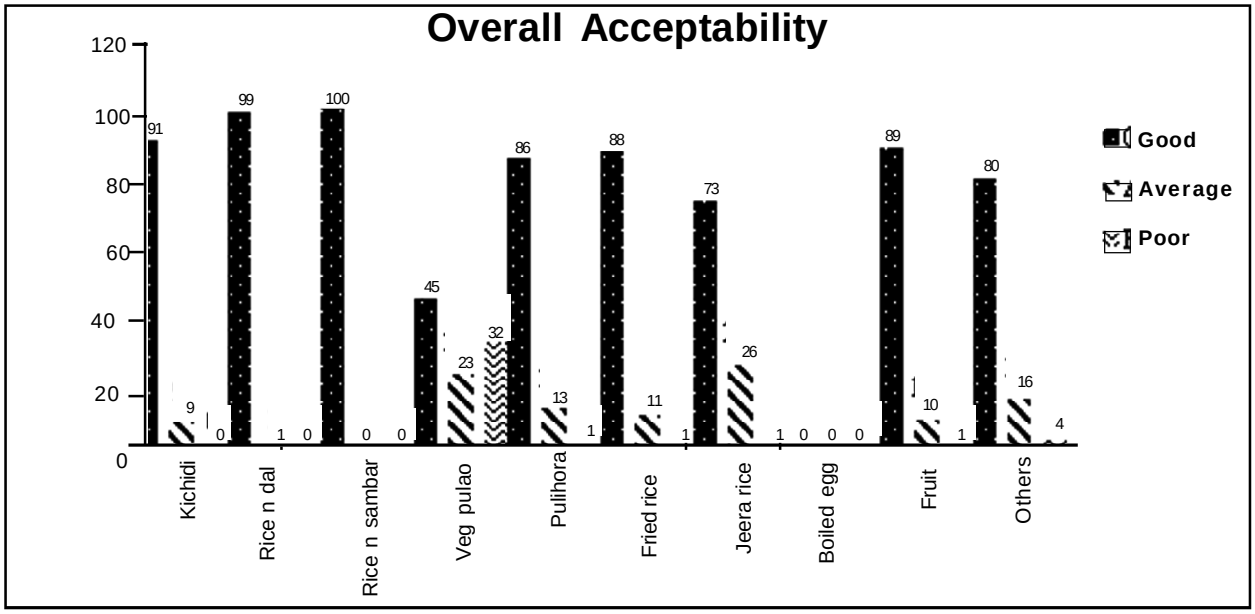

Fig.1. Overall acceptability of Mid Day Meal by the children

Rice and Dal and Rice and Sambar were the most accepted mid day meals from the point of quantity, appearance, flavor, texture, taste and quality by more than 95% of children, mainly for the family and native habit and liking. Tamarind rice, Fried rice and Khichdi were the next best meals accepted by 87-91% children, while Vegetable pulao served was felt to be inadequate in quantity. Other quality parameters of Tamarind rice, Fried rice, Khichdi and Vegetable pulao were felt to be good by 72-88% of children (fig.1).

Fruits and snacks were felt to be good by nearly 90%, while 10% children complained of spoilage of fruit and staleness of snacks. One major complaint on meal supplied was that, boiled egg was not provided by Akshya Patra unlike other MDM 'on the spot kitchens' serving boiled egg twice a week. Egg is one of the most nutritious food and very well accepted food by the children.

From the study it was observed that all the children had MDM served only during lunch break and consumed food in the school premises itself and nobody carried it home. Some of the complaints of children and teachers were that the food was getting cold by the time it was served, because the delivery of the food was too early., buttermilk was getting heated up due to use of plastic cans and leaving the cans outside in the hot sun for a long time in school grounds. Dal preparations especially sambar was dilute up to 3/4th of the cans due to the improper dispersion of dhal mash and due to high depth of the cans mixing could not be done effectively while serving.

On an overall basis, parents of school children and the teachers were also satisfied with the MDM obtained through Akshya Patra, but absence of egg in MDM was a concern for them. As per Govt. norms and as a food being liked and well accepted for its taste and nutrition it was felt and expressed by the community that inclusion of egg will be beneficial.

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SUPPLY CHAIN ANALYSIS OF LITCHI IN MUZAFFARPUR DISTRICT OF BIHAR

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Litchi (*Litchi chinensisSonn*), an important sub-tropical evergreen fruit crop belonging to family Sapindaceae, is believed to have originated in China, where it has been grown in Southern Guangdong state for thousands of years. It is highly specific to climatic requirements and probably due to this reason its cultivation is restricted to few countries in the world.

In India, litchi was introduced in the 18th century through Burma, and from there, it spread to many countries. India and China account for 91 percent of the world litchi production but it is marketed locally. In India, during 2014, 585300 MT of litchi was produced annually from 84200 ha. Agricoop, 2014.

Litchi being exacting in climatic requirement is confined to a few states with 55 percent of production recorded in Bihar. In this state, litchi is the livelihood for thousands of people as it provides both on-farm and off-farm employment. Small and marginal farmers get additional income from litchi plants in their homesteads. Thus, litchi cultivation is the livelihood security for a large population, especially in the state of Bihar. In the year 2014, litchi orchards occupied 31480 ha with 234200 MT productions in Bihar (http://www.agricoop.nic.in, 2014). Bihar is the largest producer of litchi followed by, West Bengal, Jharkhand, Assam, Punjab, Chhattisgarh and Odisha. According to the Directorate of Horticulture (DoH) 2014, database litchi is produced in 27 districts in Bihar. Muzaffarpur is the largest litchi producing district with a production of 56,006 MT followed by Vaishali at 26, 498 MT and Sitamarhi at 15,518 MT. West Champaran, East Champaran and Katihar are other three districts having production of more than 10, 000 MT.

The study was conducted in Muzaffarpur district which stands first in litchi area and production in Bihar. Muzaffarpur district has 16 blocks out of which four blocks mainly Kanti, Mushahari, Motipur and Saraiwere selected based on the criteria of highest area and production.

The study used both primary and secondary sources to collect the relevant data. The primary data was collected from a sample of 60 litchi growing farmers and 80 market intermediaries through personal interview with the help of pre-tested schedule. Secondary data pertaining to litchi production and area from 2005-06 to 2014-15 was collected from Department of Agriculture and Cooperation, Govt. of India, 2014 and from National Research Centre (NRC) on Litchi, Muzaffarpur. Data was analysed using average and percentages.

The study specifically aimed to understand the marketing channels, price spread and marketing efficiency of litchi supply chain in the survey area and also the constraints faced by farmers and market intermediaries in the marketing of litchi.

In the study it was noticed that four channels of marketing were prevalent for marketing of litchi.

Channel I : Producer – Pre-harvest contractor – Commission agent (cum Wholesaler) – Retailer – Consumer.

Channel II : Producer– Village Trader – Wholesaler (local) – Commission agent (distant) – Wholesaler (distant) – Retailer – Consumer.

Channel III: Producer – Retailer – Consumer.

Channel IV: Producer – Consumer.

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Table 1. Price Spread in Different Channels Involved in Litchi Marketing

Particulars	Channel I	Channel II	Channel III	Channel IV
Net price received by producer (Rs/quintal)	1400	1400	1400	1400
Consumer purchase price (Rs / quintal)	3866.27	10858.28	3224.08	1993.38
Price spread	2466.27	9458.28	1824.08	593.38

The price spread of different channels is presented in the Table 1. The price spread in Channel IV is the lowest because it is the shortest channel (Rs. 593.38). Whereas the price spread in Channel I, Channel II and Channel III are Rs. 2466.27, 9458.28 and 1824.08 respectively.

Table 2. Marketing Efficiency of Litchi in Different Channels

Particulars	Channel I	Channel II	Channel III	Channel IV
Value of marketing output	3866.27	10858.28	3224.08	1993.38
Total marketing cost*	2215.94	8972.64	1466.92	187.88
Marketing efficiency	0.74	0.21	1.19	9.60

**Total marketing cost includes marketing cost and profit margin of intermediaries*

Marketing Efficiency Index (MEI) represents the effectiveness of a marketing system in which it operates. The marketing efficiency for Channel I, II, III and IV were 0.74, 0.21, 1.19 and 9.60 respectively. It is observed from this efficiency index, that Channel IV was the most efficient one, because of the fact that Channel IV does not involve any intermediary. The Channel II is seen as the least efficient one because of the lengthier marketing channel and multiplicity of margins to the intermediaries and losses due to spoilage.

To identify the problems in marketing of litchi, producers, pre-harvest contractors, wholesalers, retailers etc. who are the important market intermediaries were interviewed with the help of the questionnaire. The ten most important problems encountered by them were listed and the respondents allotted the ranks to each of them. Using the Rank Based Quotient (RBQ), quantification was done based on the responses and overall ranking is calculated and presented in Table 3. It is well known that litchi is a perishable commodity and do not last long in normal conditions. Therefore high perishability is the biggest challenge to farmers as well as intermediaries, therefore it is perceived as the most important problem with an RBQ value of 98.93. To overcome this problem, there were no proper cold storage facilities available in the area leading to heavy spoilage losses and therefore the respondents expressed this as a second most important constraint with RBQ of 82.36. Similarly labour shortage during the peak harvest season was ranked third most important problem with RBQ value of 64.07. The producers have to face this problem as they cannot postpone the harvest time and the labour demand more wages. Lack of timely market information to the respondents due to which they are not aware of the market arrivals, the prices existing in different markets etc., results in distress sales and most of the times the producers are cheated. Therefore this problem is ranked as fourth amongst all the constraints with RBQ of 64.57. Inspite of litchi being a most important crop in the area and highly perishable nature of the commodity, there is no good market infrastructure facility which can help in streamlining the marketing system so this problem is ranked fifth with RBQ of 59.71.

Table 3. RBQ of constriants associated with marketing of Litchi

S.No.	Constraints	Rank										R.B.Q	Overall rank
		I	II	III	IV	V	VI	VII	VIII	IX	X		
1	Lack of organized marketing	0	7	31	46	4	19	7	8	13	5	59.64	VI
2	Lack of credit facility	0	0	0	8	3	4	32	39	32	22	30.36	VIII
3	Perishability of fruits	125	15	0	0	0	0	0	0	0	0	98.93	I
4	Lack of market information	0	2	32	36	45	16	5	4	0	0	64.57	IV
5	High transportation cost for distant markets	2	7	2	8	4	19	31	46	13	8	40.71	VII
6	Unorganized production	0	5	4	2	2	4	17	19	50	33	27.21	IX
7	Lack of marketing infrastructure	0	15	19	21	18	46	9	6	4	2	59.71	V
8	Labour shortage during harvest	0	13	32	31	21	23	18	1	1	0	64.86	III
9	Lack of cold storage facilities	8	75	27	13	9	5	3	0	0	0	82.36	II
10	Price fluctuation	0	0	1	1	1	2	12	18	35	70	19.50	X

The other problems faced in marketing are lack of organized marketing, high transportation cost for distant markets, lack of credit facility, unorganized production, price fluctuations etc. in the decreasing order of importance.

Therefore, it is suggested that to increase the shelf life of the fruit and avoid spoilage losses, establishment of cold storage facilities and provision of cold chains to transport to distant markets must be taken up. With the help of an appropriate mechanism, the number of intermediaries can be reduced and the commission paid to the mediators can be avoided. Marketing infrastructure such as better access to market yards, better roads, good transport facilities, timely payment, provision of storage facilities, credit provision, setting up of co-operative marketing units for marketing and establishment of processing units in litchi production zone could be done so as to reduce post harvest losses, which in turn will improve the socio-economic condition of the producers. Besides this the government should also extend support both technical and financial to the farmers which will improve the productive and the farmers can also receive a better price.

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GUIDELINES FOR THE PREPARATION OF MANUSCRIPT

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Journals and Bulletins

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Hu, J., Yue, B and Vick, B.A. 2007. Integration of trap makers onto a sunflower SSR marker linkage map constructed from 92 recombinant inbred lines. Helia. 30 (46) :25-36.

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AOAC. 1990. Official methods of analysis. Association of official analytical chemists. 15th Ed. Washington DC. USA. pp. 256

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Thesis

Ibrahim, F. 2007. Genetic variability for resistance to sorghum aphid (*Melanaphis sacchari,* Zentner) in sorghum. Ph.D. Thesis submitted to Acharya N.G. Ranga Agricultural University, Hyderabad.

Seminars / Symposia / Workshops

Naveen Kumar, P.G and Shaik Mohammad 2007. Farming Systems approach – A way towards organic farming. Paper presented at the National symposium on integrated farming systems and its role towards livelihood improvement. Jaipur, 26 – 28 October 2007. pp.43-46

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Bind, M and Howden, M. 2004. Challenges and opportunities for cropping systems in a changing climate. Proceedings of International crop science congress. Brisbane –Australia. 26 September – 1 October 2004. pp. 52-54
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