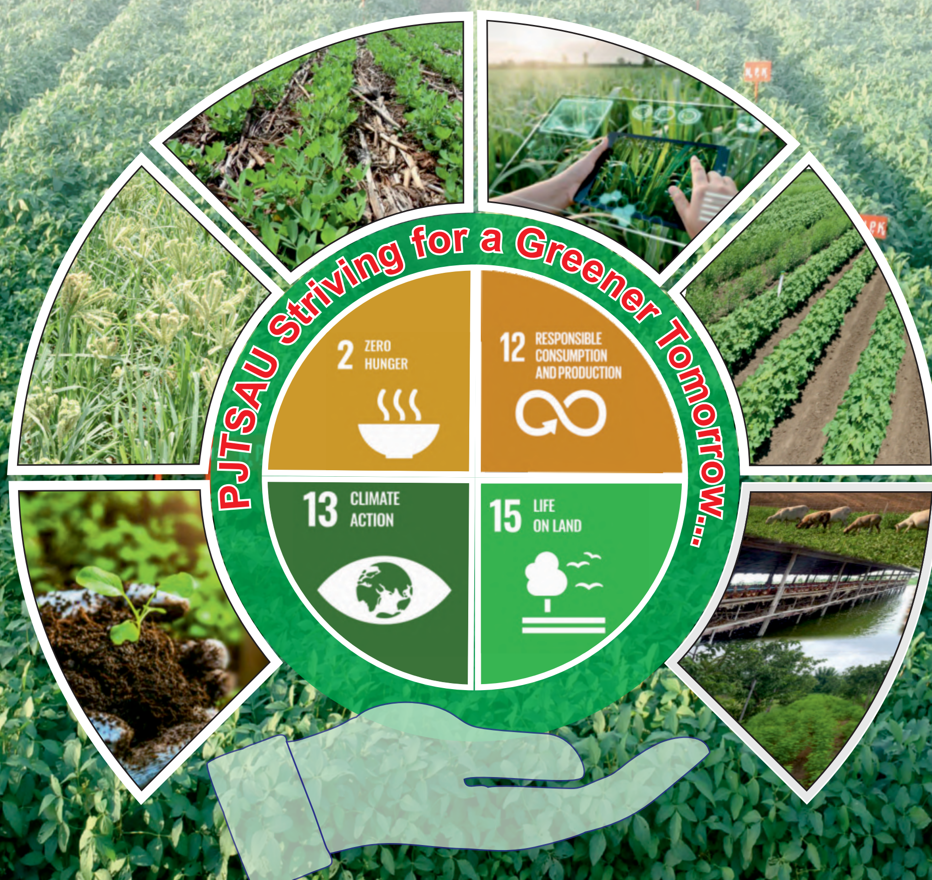
AGRO TECHNOLOGIES
2022-23

Natural Resource Management & Crop Production, Farm Mechanization and Crop Protection



Professor Jayashankar Telangana State Agricultural University
Rajendranagar, Hyderabad, Telangana State, India.

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www. pjtsau.edu.in

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Sri M. Raghunandan Rao, IAS
APC & Secretary to Govt. & Vice Chancellor, PJTSAU

Compiled and Edited by:
P. Raghu Rami Reddy, K.B. Suneetha Devi, R. Vijaya Kumari, V. Ramulu, V. Bharathi, T. Sukruth Kumar and Ch. Pragathi Kumari

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Professor Jayashankar Telangana State Agricultural University
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PROFESSOR JAYASHANKAR TELANGANA STATE AGRICULTURAL UNIVERSITY
Administrative Office. Rajendranagar, Hyderabad - 500 030, Telangana State, India

M. RAGHUNANDAN RAO, IAS
VICE CHANCELLOR

Phone : +91 - 40 - 24015122
Fax : +91 - 40 - 24018653
Email : vcpjtsau@gmail.com

FOREWORD

The Professor Jayashankar Telangana State Agricultural University has been pioneering in the science-led growth and development of agriculture in Telangana State. Taking this endeavour forward, the University was able to achieve rapid strides in the release of new varieties in field crops and related agro technologies through research & development. The University has focused on tackling the location specific research gaps and research programmes for efficient management of available farm resources and increasing crop productivity. These field research results were developed into agro technologies and promoted through extension division by providing technology backstopping and awareness programmes.

Applying advanced technology and technical innovations in agriculture have significantly increased input use efficiency and output. These Agro technologies helps the farmers when adopted in their farming operations in increasing the crop productivity and reducing wastage of water, fertilizer, and pesticides besides improving working conditions of farm workers. Technological advancements are today integral to attaining sustainability goals in agriculture. Satellite and GPS technologies, sensors, smart irrigation, drones, and automation, to list a few, provide the means for precision agriculture, which further aids in effective resource utilization. The dedicated efforts of university researchers across disciplines and research stations have yielded several technologies with potential to create long lasting impact on present agro-economyrelated to resource management and production enhancement. Twenty-three such agro-technologies on Natural resource management & Crop production, Mechanization and Crop protection developed at PJTSAU during the preceding year were compiled and presented in this book "**Agro-Technologies 2022-23"** for the benefit of all stakeholders concerned.

On this occasion, I commend the wisdom, perseverance and efforts of all the research scientists involved in development of these Agro Technologies. All the technical personnel, university officers involved in the compilation and publication of this book also deserve my wholehearted appreciation.

Date: 19-03-2024
Place: Hyderabad

M. Raghunandan Rao

PROFESSOR JAYASHANKAR TELANGANA STATE AGRICULTURAL UNIVERSITY
Administrative Office. Rajendranagar, Hyderabad - 500 030, Telangana State, India

Dr. P. RAGHU RAMI REDDY
M.Sc.(Ag), Ph.D
DIRECTOR OF RESEARCH

Office : 040-24015011 (7 lines)
040-24015161 (3 lines)
Ext: 326
Direct : 040-24015078
Mobile : + 91 912 110 7203
e-mail: dr.pjtsau@gmail.com

PREFACE

Development of best agricultural practices is vital in producing quality food and the maintenance of ecosystem's health. In this regard Professor JayashankarTelangana State Agricultural University is playing a pivotal role in the form of introducing modern technologiesin crop production and protection including natural resource management. Feeding the rapidly increasing global population amid the climate crisis requires the speed and accuracy that technology provides. New innovations in agriculture have shown us how technology can help us build more sustainable food systems and improve food security in every corner of the world.

Natural resource management and sustainable agriculture aim to increase agricultural productivity by using best practices that maintain the ecological and biological integrity of the environment for a long time. Food and other production systems in various ecologies, locations, and cultures can pose challenging issues that require a holistic, system-oriented approach. By protecting and conserving natural resources which help us to ensure that the resources are available for use not only today, but in the future as well.

The incessant efforts of multi-disciplinary research efforts of scientists of PJTSAU resulted in a spectacular increased production, productivity and consequently more food, protection of the environment andpreservation of farm products in the state. The competitive agro technology modules being developed by the university scientists and tested by the extension personnel on the farmers' fields in continuum are meeting in resolving the emerging problems of the arising demands of all the stakeholders in the present day agriculture.

I hope this publication **"Agro-Technologies 2022-23"** covering natural resource management, crop production, mechanization and protection would be of immense practical value to all the stake holders in resolving the emerging field problems and would meet the requirements of farming community. I take this opportunity to congratulate all the Scientists responsible for generating these solutions and appreciate all the personnel involved in bringing out this important publication.

Date: 19-03-2024
Place: Hyderabad

P. Raghu Rami Reddy

1 Standardization of Nitrogen Levels and its Time of Application in Dry Converted Wet Rice

Salient Features

In the recent years, monsoon arrival is getting delayed leading to late release of water under canal commands. Further, dwindling groundwater resources coupled with huge expenditure involved in development of upcoming irrigation projects emphasizes the need for dry converted wet rice system to overcome the problem of delayed transplanting and water scarcity. Nitrogen management for dry converted wet rice (DSR) is different from traditional transplanted rice because of different development processes and crop management practices. Appropriate N application levels in D-DSR not only reduces the N loss but also meet the N demands of rice crop growth to maximize DSR yield.

Field view of Dry converted wet rice

Performance

The dry direct seeded rice during *vanakalam* produced significantly higher grain yield with application of 140 kg N ha^{-1} and on par with 160 kg N ha^{-1} in Northern Telangana Zone (RARS, Jagtial and at RS&RRS, Rudrur). Scheduling of nitrogen as $1/5^{th}$ (28 kg) at basal +2/5 each at 20 DAS (56 kg) and 50 DAS (56 kg) has realized significantly higher rice grain yield (5624 kg ha^{-1}) and registered higher net returns (₹ 79,547 ha^{-1}) and B:C ratio (3.12) (RARS, Jagtial). Application of nitrogen in three splits (1/4+1/4+1/2) at basal, 20 and 50 DAS has realized significantly higher rice grain yield (6030 kg ha^{-1}) and registered higher net returns (₹ 74,997 ha^{-1}) and B:C ratio (2.66) at RS&RRS, Rudrur.

Application of 120 kg N ha^{-1} in two splits 1/2 each at basal, 20 and 50 DAS realized significantly higher rice grain yield (5395 kg ha^{-1}) and registered higher net returns (₹ 74,085 ha^{-1}) and B:C ratio (2.48) in Central Telangana Zone (RARS, Warangal)

Performance of the crop with 140 kg N applied in 3 splits ($1/5^{th}$ as basal + $2/5^{th}$ at 20 and 50DAS)

Cost of Technology

The cost of technology (20 to 40 kg N ha^{-1} higher than recommended nitrogen *i.e* 120 kg ha^{-1} in 3 split doses) is ₹ 700 ha^{-1}.

Impact and Benefits

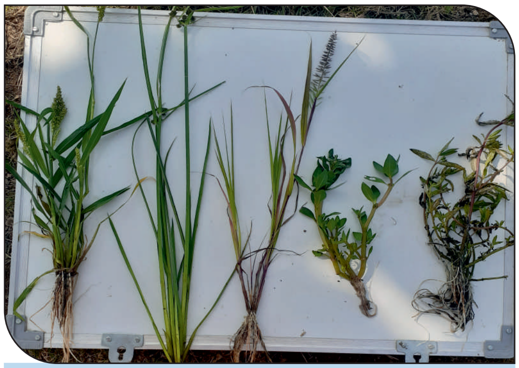
Application of 140 kg N at 3 splits scheduled as (1/5, 2/5 & 2/5) at RARS, Jagtial and as (1/4, 1/4 & 1/2) at RS & RRS, Rudrur at basal, 20 & 50 DAS and 120 kg N in 2 splits (1/2 each) at 20 and 50 DAS at RARS, Warangal respectively is recommended for managing crop demand more efficiently under dry converted wet rice system to achieve higher grain yield and net returns.

Contact

Associate Director of Research,
Regional AgriculturalResearch Station,
Jagtial/Warangal, Telangana

Principal Scientist (Agro) and Head
Regional Sugarcane and Rice Research Station
Rudrur, Nizambad, Telangana-503118
Phone:08467-284024
Email:rsrrs.head@gmail.com

2 Weed Management in Wet Direct Seeded Rice (W-DSR)


Weed flora in Wet Direct Seeded Rice


Field view of Weed management in W-DSR

Contact

Associate Director of Research,
Regional Agricultural Research Station,
Jagtial/Warangal/Palem, Telangana

Scientist (Pl. Br.) & Head,
ARS, Kunaram

Salient Features

Wet direct-seeded rice (W-DSR) is a method of rice cultivation which involves sowing pre-germinated seeds on or into puddled soil. In view of late onset of monsoon and late release of canal water and labor shortages, this method is an effective alternative to the puddled transplanted rice system. The weeds and rice seedlings emerge simultaneously due to lack of ponding water and results in heavy weed infestation under W-DSR. This has necessitated the use of herbicides for effective and cost-efficient weed control. The appropriate combination of pre and post emergence herbicides were evaluated in W-DSR along with the cost economics.

Performance

The dominant weed flora observed in W-DSR were *viz.*, *Echinochloa crusgulli, Cyperus deformis, Dinebra retroflexa, Bergia repens* and *Eclipta alba.* Application of Pretilachlor 30.7% EC @ 0.45 kg ha^{-1} PE followed by Triafamone 20% + Ethoxysulfuron 10% WG 44 @22.5 g ha^{-1} (Ready mix) PoE and Pretilachlor 30.7% EC @0.45 kg ha^{-1} PE followed by Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD @135 g ha^{-1} (Ready mix) PoE has recorded on par yields (7522 & 7233 kg ha^{-1}) with higher weed control efficiency (87.6 and 85.6%) at 60 DAS and lower weed index (4.7 and 8.5), respectively in NTZ (RARS Jagtial and ARS Kunaram).

In CTZ, application of Pretilachlor 30.7% EC @0.45 kg ha^{-1} PE followed by Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD @135 g ha^{-1} (Ready mix) PoE + Need based manual weeding (100% weed free) recorded significantly higher rice grain yield (6,883 kg ha^{-1}). Whereas, in STZ (RARS, Palem) application of Pretilachlor 30.7% + Pyrazosulfuron Ethyl 0.75% WG 15 @600 g ha^{-1} (Ready mix) PE followed by Mechanical weeding at 20-25 DAS has recorded lower weed index (3.63), higher WCE (95.0%) and grain yield (6560 kg ha^{-1}).

Cost of Technology

The cost of technology is ₹ 3210-4622 ha^{-1} which is less compared to manual weeding where labour incurred more cost (₹10,000 ha^{-1}) for weed control.

Impact and Benefits

The combination of pre and post emergence herbicides have been found to be effective and cost effecient in control of weeds in wet direct seeded rice.

3 Weed Management in Dry Direct Seeded Rice (D-DSR)

Salient Features

Dry-DSR is a method of rice cultivation, wherein, rice seeds are sown directly in the un puddled and unsaturated soil just like any ID crop. Weeds emerge simultaneously with rice seedlings and grow more quickly than in puddled transplanted rice. Therefore, weeds are the main biological constraint to the success of DSR and failure to control weeds result in yield losses ranging from 50 to 90%. Because of labour scarcity at critical time of weeding and increasing labour costs, use of herbicides is becoming more popular in dry DSR because of its more effective weed control, easy to apply, provide selective control, saves on labour and less cost.

Overall field view of Dry DSR

Performance

At RARS Jagtial and at ARS, Kunaram (NTZ), application of Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 @ 20 g ha^{-1} (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44 @22.5 g ha^{-1} (Ready mix) PoE and Pendimethalin 38.4%CS @ Pyrazosulfuron ethyl 0.85% ZC 900 @ 20 g ha^{-1} (Ready mix) followed by Penoxsulam1.02 % + Cyhalofop-butyl 5.1% OD @135 g ha^{-1} (Ready mix) PoE treatments has recorded comparatively lower weed density of all types of weeds (grasses, sedges and BLW) and higher weed control efficiency (76.4% and 71.4% at 60 DAS), rice grain yield (4426 & 4477 kg ha^{-1}, respectively) with higher net returns (₹ 55358 ha^{-1}) and B:C ratio (2.34) in Dry Direct Seeded Rice (D-DSR). Further, application of Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 @ 20 g ha^{-1} (Ready mix) PE followed by Metsulfuron Methyl 10% + Chlorimuron ethyl 10% WP @ 4 g ha^{-1}+ Cyhalofop Butyl 10% EC @ 75 g ha^{-1} (Tank mix) PoE was also comparable with the above two herbicide combinations.

Similarly in the STZ (RARS, Palem), application of Pendimethalin 38.7% + Pyrazosulfuron ethyl 0.85% ZC 900 @ 20 g ha^{-1} (Ready mix) was found effective in controlling weeds in initial stages. However, in the Post emergence herbicide evaluation, mechanical weeding at 20-25 DAS and 40- 45 DAS was found best to control the weeds and Penoxsulam 1.02 %+ Cyhalofopbutyl 5.1% OD @ 135 g ha^{-1} (Ready mix) was found effective after mechanical weeding.

Performance of Dry direct seeded rice with best combination of herbicides at RARS, Jagtial

Cost of Technology

The cost of technology, *i.e.*, combination of pre emergence and post emergence herbicide is ₹ 4825-5650 ha^{-1} which is less compared to manual weeding where the involvement of human labour incurred more cost (₹ 10,000 ha^{-1}) on labour for weed control.

Impact and Benefits

The suitable combination of pre and post emergence herbicides help to mitigate weed infestation and achieve higher productivity and profitability in dry DSR. Further, use of herbicides are more effective, easy to apply, provide selective control, saves on labour with less cost and make D-DSR is a viable option compared to traditional transplanted rice.

Contact

Associate Director of Research,
Regional AgriculturalResearch Station,
Jagtial/Palem, Telangana

Scientist (Pl.Br) & Head,
ARS, Kunaram

4 Integrated Weed Management in Cotton based Intercropping System

Cotton + Soybean intercropping

Cotton + Sesame intercropping

Cotton + Dhaincha intercropping

Salient Features

Cotton is a wide spaced initially slow growing crop and consequently vulnerable for weed infestation. Development of appropriate intercropping system will curtail the weed problem. Screening of the herbicides suitable for intercropping situation is essential for efficient weed control and crop safety. Selective herbicides are available for weed control in cotton under sole crop but under intercropping situation selective herbicides are not available. It is necessary to find out the best weed management practice for efficient weed control for intercropped cotton.

Performance

Growing soybean as intercrop in cotton at 1:2 ratio in alfisols suppressed the weed growth as it is evident from reduced weed density and weed dry weight compared to sole crop and intercroped with sesamum and *dhaincha* (live mulching upto 40 DAS) and gave 7.0 percent additional cotton equivalent yield (1769 kg ha^{-1}) over sole cotton (1653 kg ha^{-1}). However, the net returns and B:C ratio was at par with sole cotton + IWM.

Application of pendimethalin (38.7 CS) 640 g ha^{-1} as PE *fb* hand weeding at 30 and 45 DAS (IWM) in cotton + soybean intercropping was found to be effective for weed control and resulted in higher cotton equivalent yield (1762 kg ha^{-1}) over chemical weed control i.e., pendimethalin (38.7 CS) @640 gha^{-1} as PE *fb* quizalofop- ethyl 45 gha^{-1} as POE at 25 DAS (1397 kg ha^{-1}).

Cost of Technology

The cost of soybean intercropping in cotton (2:1) along with IWM is ₹ 28,490 ha^{-1}.

Impact

Highest cotton equivalent yield can be achieved when cotton was intercropped with soybean at 1:2 ratio in alfisols under rainfed situation coupled with application of pendimethalin (38.7 CS) @640 gha^{-1} as PE *fb* hand weeding at 30 and 45 DAS (IWM) for effective weed control in cotton + soybean intercropping system.

Contact

Principal Scientist (SSAC) & Head
AICRP on Weed Management
Rajendranagar, Hyderabad – 500 030
Telangana
Phone: 7396657949
Email: weedhydap@yahoo.co.in

5 Profitable Maize based Vegetable Cropping Sequence for Northern Telangana Zone

Salient Features

Conventional cropping system involves continuous growing of same kind of crops with the use of higher inputs. Crop diversification and intensification reduce risks associated with yield, market prices, degradation of natural resources and environment on one hand and help in attaining the national goals like self-reliance in critical crop products, earning foreign exchange and employment generation on the other hand. Maize is one of the important crops occupying third position next to rice and cotton in Northern Telangana Zone. The introduction of vegetables in the existing maize cropping sequence is an effective option for improving profitability, viability and sustainability of the system.

Performance

Okra - maize cropping system yielded higher system productivity (24718 kg ha^{-1}), system profitability (₹ 874 ha^{-1}day^{-1}), production efficiency (111.6 kg ha^{-1} day^{-1}), system gross returns ((₹ 4,72,067 ha^{-1}), system net returns(₹ 3,18,995 ha^{-1}) and benefit cost ratio (3.09) followed by maize-onion cropping system, with system productivity (22,039 kg ha^{-1}), system profitability (₹ 749 ha^{-1}day^{-1}), production efficiency (99.9 kg ha^{-1} day^{-1}), system gross returns (₹ 4,20,932 ha^{-1}), system net returns (₹ 2,73,506 ha^{-1}) and benefit cost ratio (2.86) over other field crops in maize based cropping systems.

Cost of the Technology

The cost of cultivation of okra-maize and maize-onion cropping system is ₹ 1,53,072/- and ₹ 1,47,426/- ha^{-1} respectively. Though the cost of cultivation of vegetable based maize cropping system is expensive than field crops based maize cropping system, but gives higher net returns to farmers.

Impact and Benefits

Diversified Maize based cropping systems with vegetable crops (Okra and Onion preceeding/ succeeding) enhances the system productivity, profitability, production use efficiency and benefit cost ratio over the traditional maize-field crops based cropping system.

Profitable Okra-Maize cropping system

Profitable Maize-Onion cropping system

Contact

The Principal Scientist and Head
Agricultural Research Station, Karimnagar-505001
Mobile No. 73373 99459
E.mail:ars.karimnagar@yahoo.com

6 Crop Diversification after *kharif* Dry DSR for Higher Productivity, Profitability and Resource Use Efficiency under Different Tillage Practices

Overview of the experimental plot at ARS, Kunaram

Sunflower, Maize and Groundnut crops raised under Conventional tillage (1 plough fb 2 cultivator and 1 rotovator) after Dry DSR

Contact

Associate Director of Research,
Regional AgriculturalResearch Station,
Palem/Jagtial/Warangal, Telangana

Scientist (Plant Breeding) & Head,
ARS, Kunaram, Peddapalli.

Principal Scientist & Head,
ARS, Tornala, Telangana.

Salient features

Rice – Rice cropping system results in deterioration of soil health and fast depletion of soil health. There is a need to identify the most profitable succeeding rabi crop to Dry direct seeded rice (D-DSR) in different zones of Telangana under different tillage practices to reduce the incidence of pests and diseases.

Performance

Growing of Maize during *Rabi* season succeeding to Dry DSR produced higher rice equivalent yield (7173-7280 kg ha^{-1}) and achieved highest gross returns (₹ 1,39,151 -1,41,224 ha^{-1}), net returns (₹ 98005 to 102894 ha^{-1}) and B: C ratio (3.25 to 3.9) and followed by rice-sunflower sequence in Northern Telangana Zone (RARS, Jagtial and at ARS, Kunaram).

Growing of Maize (RARS, Warangal) and groundnut (ARS, Tornala) recorded higher rice equivalent yield (11,558 & 6012 kg ha^{-1}) in Central Telangana Zone. Though, the REY of groundnut was higher than other crops, sunflower crop has recorded higher benefit cost ratio of 2.31 at ARS, Tornala when compared to groundnut (1.49).

Growing of rabi groundnut after *kharif* Dry DSR produced higher rice equivalent yield (5295 kg ha^{-1}) and followed by sunflower in Southern Telangana Zone (RARS, Palem).

Field preparation with conventional tillage (1 plough *fb* 2 cultivator and 1 rotavator) practice after harvest of Dry Direct seeded rice showed optimum crop establishment of *rabi* crops (Maize, Sunflower & Groundnut) and recorded higher rice equivalent yield at all centres and was on par with reduced tillage practice (2 cultivator and 1 rotavator)

Cost of Technology

The cost of cultivation (₹ ha^{-1}) of maize, sunflower, groundnut during *rabi* season succeeding to Dry direct seeded rice is ₹ 52,000, 42000 and 79000, respectively.

Impact and Benefit

The existing Dry direct seeded rice based cropping system can be effectively diversified during *rabi* season by growing maize & Groundnut ; maize & Sunflower ; and groundnut and sunflower in Northern, Central and Southern Telangana Zones respectively by practicing conventional tillage ((1 plough *fb* 2 cultivator and 1 rotavator) and reduced tillage(2 cultivator and 1 rotavator) to increase the productivity and to maintain the sustainability of rice based cropping systems.

7 Rain Water Harvesting through Farm Ponds- A Climate Resilient Technology for Sustainable Crop Production in Drylands

Salient Features

Erratic distribution of rainfall along with prolonged dryspells results in poor crop growth and partial/complete failure of dry land crops. Farm ponds would help the farmers for on farm rain water harvesting in the event of run off and helps in using stored water for saving the crop during dryspells in between the crop season and provides opportunity to grow second and sometimes third crop in succession depending on the availability of stored water there by enhancing cropping intensification and augment the ground water availability

Farm pond at ARS, Tornala

Performance

Rain water harvesting through farm ponds and application of harvested water as life saving irrigations (LSI) during dry spells (2021-22 and 2022-23) in maize, sunflower and cotton were found to be a viable technology to improve the yields and water productivity.

Application of one life saving irrigation (LSI) increased yield by 10.5, 5.7 and 29.8% under ridge & furrow and 10.8, 10.6 and 46.5% under drip method of irrigation in maize, sunflower and cotton, respectively. Likewise scheduling two life saving irrigation (LSI) increased yield by 49.8, 45.0 & 74.4% in ridge & furrow method and 53.3, 48.7 and 77.3% in drip method of irrigation in maize, sunflower and cotton, respectively.

Benefit cost ratio was higher (3.08 & 3.20) with maize crop in ridge & furrow and drip method of irrigation followed by sunflower (2.09 & 2.44).

Maize grown with drip irrigation under farm pond

Cost of Technology

Cost of construction of farm pond was ₹ 60,000/- is a one time investment and serves as a source of water for life saving irrigation during the periods of drought and erratic rainfall.

Impact and Benefit

Productivity of ID crops like maize (10.5 & 53.3%), sunflower (5.7 & 48.7%) and cotton (29.8 & 77.3%) can be enhanced by providing one or two life saving irrigations at critical stages duly utilizing limited harvested water through efficient methods of irrigation (ridge & furrow method & drip irrigation) and cropping intensity can also be increased by taking subsequent *rabi* crops (maize and sunflower) with stored water.

Contact

Principal Scientist (SS & AC) & Head
Agricultural Research Station, Tornala
Siddipet District, Telangana-502114
Phone: 7337399466
Email: ars.tornala@gmail.com

8 Climate Smart IFS Model for Irrigated Dry (ID) Areas of Telangana

Crop + Horticulture + Livestock IFS model

Horticulture unit with hedge lucerne as strip crop

Salient Features

Integrated Farming System (IFS) for marginal and small farmers under ID situation is remunerative, sustainable, eco-friendly and generating three times more employment than cultivation of crops alone in rural areas. In the IFS model, crop, horticulture and livestock components are integrated in the 1 ha area by allocating 0.7, 0.2 and 0.1 ha area to each component, respectively. Cropping unit comprising of cereal crops, pulses, oilseeds, high value crops and fodder crop (hybrid bajra napier). Horticulture included guava intercropping with hedge lucerne fodder crop. Livestock included 2 Gir breed desi cows, 20 female and 1 male Nellore jodipi sheep and 200 Aseel poultry birds. Complementary units like composting, vermi composting and biogas units were included for residue and manure recycling in the system. Model is evaluated for productivity, economic returns and other ecosystem services.

Performance

The productivity of IFS model (1 ha) in terms of rice equivalent yield was 30.68 t ha^{-1} with net returns of ₹ 2,57,706 and B:C ratio of 2.16. The maximum profit share was realized from cropping unit followed by sheep & poultry unit. Annually on an average, 2408 kg of cereals, 174 kg pulses, 716 kg oilseeds, 703 litres of milk, 295 kg of vegetables, 39.3 t of green fodder and 4.63 t of dry fodder were produced within the system. The model also meets around 46 % of input required for different enterprises within the farm besides providing all the commodities. Recycling of crop residues and manures would help to improve soil fertility of the unit with perceptible increase in soil organic carbon. Model also recorded higher Energy use efficiency (1.37), Sustainability yield index (0.72) and Diversity index (0.90).

Cost of Technology

Annual cost of production for the IFS model (1 ha) was ₹ 3,01,395/- compared to that of average cost of production of ₹ 1,05,000/- in Rice – Rice cropping system (1 ha) of Telangana state.

Impact and Benefit

IFS model of 1 ha generate year round employment with 511 man-days and provides an opportunity for nutritional security to the farm family through production of cereals, pulses, oilseeds and animal based products. Through residue recycling and manure production, on an average, 10400 kg of FYM, 506 kg of vermi compost, 3 No. LPG gas cylinders equivalent biogas and 975 kg of biogas slurry could be produced which is equivalent to 81 : 36 : 64 kg NPK and thus a saving of ₹ 7,735/- on fertilizer cost.

Contact

Principal Scientist (Agronomy) & Head
AICRP on Integrated Farming Systems
Rajendranagar, Hyderabad 500 030,
Telangana State
Phone: 9440467091
Email: aicrpcshyd@gmail.com

9 Planting Geometry, Nitrogen Nutrition and Cutting Management for Higher Fodder Productivity of Moringa (*Moringa oleifera*)

Salient Features

Moringa is an amazing plant in the context of its high nutritional content. Moringa foliage contains substantial amounts of pro-vitamin A (624.4 µg retinol equivalent and vitamin C (65.9 mg, protein (24.3 g, calcium (1,443.9 mg, magnesium (176.7 mg and iron up to 53.7 mg for 100 g dry weight. It is also useful for livestock for providing balanced nutrition as fodder. However, research available on moringa as forage crop was very little. Small and marginal livestock farmers who depend heavily on natural community grazing lands are particularly vulnerable to climate change as well as to food insecurity. Moringa (drumstick) was evaluated for its ability to produce fodder / foliage at different geometry and cutting intervals.

Field view of Moringa raised for Fodder purpose

Performance

The planting geometry of 45 cm X 30 cm for moringa has recorded higher green (472.7 q ha^{-1}), dry fodder yield (104.0 q ha^{-1}), crude fibre content (19.6 %) and crude protein yield (20.2 q ha^{-1}). Among different cutting regimes, cutting at 75 days interval has accrued significantly higher green (542.3 q ha^{-1}), dry fodder yield (124.0 q ha^{-1}) and crude protein yield (24.9 q ha^{-1}). A planting geometry of 45 cm X 30 cm with 150 kg ha^{-1} nitrogen application and a cutting interval of 75 days has resulted in higher net returns (₹ 1, 23, 091 ha^{-1}) and B:C ratio (3.9).

Performance of Moringa at different N levels and Cutting management

Cost of Technology

The cost of cultivation of technology (addition of 50 kg N and 75 days cutting interval with 45 cm X 30 cm spacing) is ₹ 2205.

Impact and Benefit

Moringa with a spacing of 45 cm x 30 cm, nitrogen application of 150 kg ha^{-1} and with a cutting interval of 75 days is recommended for optimum green, dry fodder yield, higher crude protein and fibre yield. Cultivation of moringa as a fodder in marginal community grazing lands to provide balanced nutrition to the livestock was found to remunerative.

Contact

Principal Scientist (Pl. Br.) & Head
AICRP on Forage Crops
ARI, Rajendranagar
PJTSAU, Hyderabad – 500 030
Telangana
Phone: 9849152482
Email: forage_hyd@yahoo.co.in

10 Nitrogen and Cutting Management for Higher Productivity of Multicut Forage Pearlmillet

Overview of the experiment

Performance of pearlmillet multicut variety TSFB 15-8

Salient Features

Pearl millet (*Pennisetum glaucum* L.) is one of the most widely adapted cereal forage crops under rainfed conditions and it is gaining popularity in Maharashtra and Telangana due to its rapid growth, high quality forage and improved palatability. The productivity of multicut forage pearlmillet under irrigated or rainfed conditions can be improved through high yielding varieties, balanced nutrition and cutting management. Nitrogen is an essential nutrient for vegetative growth of forage crop and plays a critical role in increasing forage productivity and quality. It is necessary to standardize the nitrogen dose and cutting management for higher productivity of newly released pearlmillet varieties.

Performance

Pearl millet multicut forage variety TSFB 15-8 along with 120 kg nitrogen ha^{-1} recorded significantly higher green (833.5 q ha^{-1}) and dry fodder (192.6 q ha^{-1}) yields followed by Moti Bajra (720.7 q ha^{-1} and 166.5 q ha^{-1}, respectively) while both the varieties have shown at par Crude protein yield. Maximum plant height of 78.8 cm was reported by TSFB 15-8 with average of 4 tillers per plant. Cutting management of three cuts (Ist cut at 50 DAS, IInd cut at 30 DAS after first cut and IIIrd cut at 50% flowering after second cut) recorded higher green fodder (776.1 q ha^{-1}), dry fodder (177.6 q ha^{-1}) and crude protein yield (10.8 q ha^{-1}) compared to the 80 kg nitrogen ha^{-1} and cutting management of two cuts (Ist cut at 50 DAS and IInd cut at 30 DAS after first cut).

Cost of Technology

The cost of cultivation of technology (20 kg higher N ha^{-1}) than recommended dose (100 kg N ha^{-1}) with three cuts is ₹ 8,244.

Impact and Benefit

The variety TSFB 15-8 with 120 kg nitrogen ha^{-1} and with three cuts (Ist cut at 50 DAS, IInd cut at 30 DAS after first cut and IIIrd cut at 50 % flowering after second cut) has recorded significant higher green and dry fodder yields with high B:C ratio (3.0) and supply green forage over a period of 120 days.

Contact

Principal Scientist (Pl. Br.) & Head
AICRP o Forage Crops
ARI, Rajendranagar
PJTSAU, Hyderabad- 500030
E-mail: forage_hyd@yahoo.com

11 Gypsum - A Better Source for Enhancing the Productivity of Sunflower in Sulphur Deficient Soils

Salient features

Sulphur is the next important nutrient after primary nutrients and has influence on oil content and yield of crops. Sunflower crop yield and oil content are influenced by sulphur nutrition. Gypsum ($CaSO_4.2H_2O$) is the cheapest source of sulphur and contains sulphur (18.6%) and calcium (23.3%). The use of gypsum, as a source of sulphur fertilizer by farmers leading to higher yields and oil content of the sunflower crop.

Performance

The application of sulphur @ 40 kg ha^{-1} through gypsum along with recommended dose of fertilizer (RDF) (75-90-30 kg N, P_2O_5 & K_2O ha^{-1}) produced higher test weight (5.87 g) and seed yield (1851 kg ha^{-1}) in sunflower over ammonium sulphate and elemental sulphur applied at 20, 40 and 60 kg ha^{-1}. Application of sulphur @ 40 kg ha^{-1} through gypsum has not only increased the sunflower seed yield (28%) also recorded highest gross returns (₹ 1,13,566/- per ha), net returns (₹ 59,045/- ha^{-1}) and B:C ratio (2.08).

Overview of the experiment

Cost of Technology

An additional cost of ₹ 4,315 ha^{-1} is required to supply 40 kg sulphur through Gypsum in addition to the recommended dose of fertilizers.

Impact and Benefit

Application of sulphur @ 40 kg ha^{-1} through gypsum is the economical and cheapest source compared to other sources (elemental sulphur and ammonium sulphate) along with RDF recorded highest net returns of ₹ 59,045/- ha^{-1} besides contributing to the improved soil structure and soil health.

Performance of Sunflower with RDF and S application @ 40 kg ha^{-1} through gypsum

Contact

Principal Scientist (SS & AC) & Head
Agricultural Research Station, Tornala
Siddipet District, Telangana-502114
Phone : 7337399466
Email : ars.tornala@gmail.com

12 Soil Test Based Fertilizer Prescription for Targeted Yield of Soybean in Vertisol

Over view of the experiment field

Performance of soybean in targeted yield experiment

Salient Features

Precision agriculture guided with soil test nutrient data and crop requirement is considered as shift towards a more sustainable approach. This strategic shift not only curtails the financial burden associated with fertilizer imports but also fosters a balanced and eco-friendly agricultural ecosystem. STCR equations developed for soybean crop in vertisols or black soils of Telangana (NTZ) and its adoptability in farmers field enhances their income and saves costly inputs.

Performance

In the vertisols of Telangana a targeted soil test-based prescription equations were developed for targeted soybean crop yield of 25q ha^{-1}. This tailored approach caters to two distinct scenarios: one involving the application of chemical fertilizers alone and the other incorporating the use of vermicompost as well.

Only with chemical fertilizers	With Chemical fertilizers + Vermicompost @ 5t ha^{-1}
FN=5.84 T-0.35 STVN	FN=5.84 T-0.35 STVN-0.12 VCN
FP=2.86 T-1.06 STVP	FP=2.86 T-1.06 STVP-0.11 VCP
FK=2.14 T-0.08 STVK	FK=2.14 T-0.08 STVK-0.08 VCK

(T = Target in q ha^{-1}; FN, FP and FK = Fertilizer Nitrogen, Fertilizer P_2O_5 and Fertilizer K_2O, respectively; STVN, STVP and STVK = soil test values for N, P and K in kg ha^{-1})

Against the initial soil test values of 228 kg N, 48 kg P_2O_5, and 228 kg K_2O ha^{-1}, a target-based approach was employed to estimate N, P and K fertilizer requirements for soybean cultivation. Utilizing a tailored equation, the recommended application was 81kg N, 40kg P_2O_5, and 35kg K_2O ha^{-1} to achieve a target yield of 25 quintals ha^{-1} with chemical fertilizers alone. In comparison, an alternative strategy suggested is 77kg N, 38kg P_2O_5, and 27kg K_2O supplemented through 5t ha^{-1} of vermi compost to reach the same yield. The soil test-based prescriptions compared with the general RDF (60-60-40) in Vertisols, deviation was (+21) kg N, (-) 20 kg phosphorus, and (-)5 kg potassium. The precision-based fertilizer recommendations showcase their potential for optimizing nutrient application, ensuring a targeted soybean yield of 25 q ha^{-1} in black soils of Telangana.

Cost of Technology

Generally, under soil health card scheme all the farmers get the nutrient status of soil at free or at minimal charges (₹ 10 to 20 per sample) in the government soil testing laboratories. The technology can be implemented with soil testing values and interpretation of results.

Impact and Benefit

This approach not only promotes sustainability but also optimizes input use efficiency. By regulating input costs and ensuring a judicious nutrient balance, farmers can maximize yields while minimizing environmental impact.

Contact

Principal Scientist (Agro) and Head
Regional Sugarcane and Rice Research Station
Rudrur, Nizambad, Telangana-503118
Phone:08467-284024
Email:rsrrs.head@gmail.com

13 Fertilizer Requirement for Irrigated Cotton in Alfisols

Salient Features

In general cotton is being grown under rainfed conditions under very deep to medium and chalka soils in the state where the yield levels also very according. Irrigation brings a set of management challenges and opportunities in cotton. In general, irrigation will increase yield potential, so fertilizer requirements will also tend to increase, particularly with reference to major nutrients. Rescheduling of fertilizer doses changed scenario of soil fertility and irrigation facilities created in the state, with regarding to increased fertilizer doses, no. of splits along with provision of four to five supportive irrigations for cotton cultivation is needed to reap higher yields with increased nutrient use efficiency.

Over view of the experiment

Performance

The highest cotton kapas yield (1940 kg ha^{-1}) was achieved under irrigated cotton at a fertilization rate of 120% RDF (144-72-72 N:P_2O_5:K_2O kg ha^{-1}) + 5 t FYM ha^{-1} which was 21% higher over cotton grown with RDF under rainfed condition. The nitrogen and potassium scheduled in 5 equal splits at an interval of 20 days (0,20,40,60,80 DAS) for Bt cotton was found optimum. The higher gross returns (₹ 1,50,842), net returns (₹ 82,185) and B: C ratio (2.20) recorded with 120% RDF+5 t FYM ha^{-1} than other treatments.

Performance of cotton with 120% RDF applied in splits

Cost of Technology

An additional cost of ₹ 1,776/- is required for application of 20% more than RDF (120-60-60 N: P_2O_5:K_2O kg ha^{-1}) along with additional one split fertilizer application cost.

Impact and Benefits

Irrigated cotton with 120 % RDF along with 5 t FYM ha^{-1} gave additional monetary benefit of ₹ 20,275 ha^{-1} than the cotton growing with RDF under rainfed condition. Increased fertilizer doses and the no. of splits along with provision of four to five supportive irrigations during the flowering stage, boll formation to boll development stages may reap higher yields of cotton.

Contact

Associate Director of Research
Regional Agricultural Research Station
Palem, Nagarkurnool, Telangana State
Phone : 8008311779,
E.mail : adrpalem@gmail.com

14 Distellery Spent Wash (DSW), an Effluent from Sugar Mills Increase the Growth and Yield of Sugarcane

Field view of the Experiment

Diluting of DSW on volume basis

Profuse tillering with DSW (30% dilution)

Salient Features

Distillery spent wash (DSW) is effluent of sugar industry released during process of distillery and is non toxic, biodegradable, purely of plant origin and contains large quantities of soluble organic matter and plant nutrients, which may be utilized by the plants for their growth and yield. In addition, the effluent contains high potassium (1.3 per cent), sulphur (0.4 per cent), appreciable amounts of nitrogen (0.2 per cent) and acts as a slow release fertilizer being mostly in the colloidal form. The distillery spent wash is the residual liquid waste generated during production of alcohol and has stringent legislative regulations of its disposal. Hence, it has stimulated the need for efficient utilization of distillery spent wash and tested on plant growth and yield of sugarcane.

Performance

Application of Distillery spent wash (DSW) 30% dilution (60 litres in 200 litres of water acre^{-1}) through drip or drenching near the plant at formative stage along with recommended dose of fertilizers (250 - 100 - 100 $N:P_2O_5:K_2O$ kg ha^{-1}) showed a stimulatory effect on growth and yield of sugarcane and realized higher plant height (343.5 cm), tiller count (159410 ha^{-1}) and cane yield (159.1 t ha^{-1}) compared with 100% RDF (127.4 t ha^{-1}) and other levels of dilution of DSW. Net returns (₹ 2,19,800/-) and benefit cost ratio (2.5) were higher with above treatment with increase in the sucrose content (19.84%) over control (18.75%).

Cost of Technology

The cost of DSW 30% (60 litres in 200 litres of water acre^{-1}) including transport and its application is ₹ 20,000/- acre^{-1}.

Impact and Benefit

Application of Distillery spent wash (DSW) @ 30% (60 litres in 200 litres of water acre^{-1}) along with recommended dose of fertilizers can be recommended for higher growth, yield and quality of sugarcane. However, the longterm effect of distillery spent wash on soil health has to be studied.

Contact

Principal Scientist (Pl. Phy) & Head

Agricultural Research Station

Basanthpur- 502249

Phone 9573299000

Email: ps.sugarcane09@gmail.com

15 Selective Mechanization for Higher Profitability at Sunflower Cultivation in Alfisols

Salient Features

Sunflower (*Helianthus annus*.L) has emerged as one of the important oilseed crops in India because of its photo insensitivity, short duration, less water requirement and good quality oil. High labour hiring cost coupled with labour scarcity enhanced the production cost of sunflower cultivation. There is a need to adopt mechanization in order to reduce the production costs and also to perform various agronomic operations within time (pre-sowing to post harvest) in order to maximize the resource utilization efficiency, improving the productivity and profitability of sunflower cultivation.

Performance

Adoption of selective mechanization practices in sunflower such as sowing with seed cum ferti drill, intercultivation with power tiller (7 HP) upto 40 DAS, line weeding with handheld weed scraper, spraying with a motorized power sprayer and harvesting with combined harvester and stubble incorporation with rotovator recorded higher seed yield (1514 kg ha^{-1}) over conventional practices (1459 kg ha^{-1}). Further, mechanization could save 58.5 man days thus, recording higher net returns (₹ 53,812 ha^{-1}) and B:C (2.3) over conventional practices (₹ 43,835 ha^{-1} and 1.9, respectively).

Cost of Technology

The cost of cultivation of sunflower sown under mechanization was ₹ 42,635 ha^{-1} as against conventional practices of ₹ 47,759 ha^{-1}.

Impact and Benefit

Adoption of selective mechanization practices in sunflower reduced the cost of cultivation by ₹ 5,124 ha^{-1} and increased the gross returns by ₹ 3,423 ha^{-1}, net returns by ₹ 9,977 ha^{-1} over conventional method.


Sowing of sunflower with seed cum ferti drill


Intercultivation with power tiller


Harvesting of sunflower with combined harvester

Contact

Principal Scientist(SS & AC) & Head
Agricultural Research Station, Tornala
Siddipet District, Telangana-502114
Phone : 7337399466
Email : ars.tornala@gmail.com

16 Cotton Residue Management for Higher Productivity of Succeeding Crops

Cotton residue incorporation using shredder and rotovator

Performance of groundnut after residue incorporation of cotton

Performance of maize after residue incorporation of cotton

Salient Features

Retention of crop residues on the soil surface as mulch or incorporation has numerous benefits to the soil and crop environment. Crop residues are also a habitat for soil biota and source of food/energy for micro and macro fauna and flora. Most crop residues are a rich source of carbon, and their application to soil is essential to enhancing soil_ organic matter content and sequestering carbon in soil. Crop residues also contain plant nutrients and are essential to elemental recycling and reducing the need for application of fertilizers. The different ways of cotton crop residue management and its influence on succeeding crops at different fertilizer levels were studied.

Performance

Cotton stalks incorporation with shredder + microbial inoculation @ 2% of stalk weight resulted significantly higher productivity of succeeding crops (greengram - 1119 kg ha^{-1} in warangal, blackgram - 1098 kg ha^{-1} & groundnut - 2705 kg ha^{-1} in RARS, Palem sesamum - 868 kg ha^{-1} in Jagital and maize - 4736 kg ha^{-1} in ARS, Karimnagar) followed by cotton stalks incorporation with rotovator + microbial inoculation @ 2% of stalk weight. Further, cotton stalks incorporation with shredder + microbial inoculation @ 2% of stalk weight resulted in higher net returns (₹ 22,695 to ₹ 89,981 ha^{-1}) and B:C ratio (1.5 to 2.58) across all the crops and centres tested followed by cotton stalks incorporation with rotovator + microbial inoculation @ 2% of stalk weight.

Application of 125% RDN to succeeding crops recorded significantly higher productivity of greengram (1175 kg ha^{-1}) in warangal, blackgram (1087 kg ha^{-1}) & groundnut (2604 kg ha^{-1}) in RARS, Palem sesamum (883 kg ha^{-1}) in Jagital and maize (4700 kg ha^{-1}) in ARS, Karimnagar) respectively and recorded higher net returns ranged from ₹ 32,931 to ₹ 83,768 ha^{-1} and B:C ratio of 1.97 to 2.51, respectively.

Cost of the Technology

Incorporation of cotton stalks with tractor drawn shredder or rotavator + microbial inoculation @ 2% of stalk weight, saves ₹ 1900 to 2500 ha^{-1} over manual removal of cotton stalks. Addition of 25% RDN in succeeding crops (Maize, Sesame, Blackgram and Greengram) costs ₹ 500-1500 ha^{-1}.

Impact and Benefits

The incorporation of cotton stalks with shredder or rotovator + microbial inoculation @ 2% of stalk weight is an appropriate strategy for effective utilization and decomposition of cotton crop residues which also act as soil amendment and improve the soil health and productivity of succeeding crops (Maize, Sesame, Groundnut, Blackgram and Greengram) in different zones of Telangana.

Contact

The Associate Directors of Research
RARS, Jagtial/Palem/Warangal
Telangana.

The Principal Scientist (Agro) and Head
Agricultural Research Station,
Karimnagar

17 Multiple Disease Management with Novel and Broad Spectrum Combination of Fungicides in Rice

Salient Features

The diseases in rice account for yield losses ranging from 9.6 to 85% wherein, blast and sheath blight are the major diseases that affecting rice crop of Telangana state. Prolonged and repeated use of fungicides with similar mode of action often results in pathogen developing fungicide resistance.

Hitherto farmers used Tricyclazole for control of this disease but need to find out alternate strategy as it is facing the challenges of fungicide resistance development and other environmental concerns. Whereas, use of blended fungicide molecules envisioned broad spectrum activity against multiple diseases of rice seamlessly bring down the cost of protection measures.

Performance

Disease incidence was found to the reduced both blast (78.5%) and sheath blight (41.6%) with blended fungicide molecule of Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 500 ml ha^{-1}, sprayed twice at initiation of disease and another spray at 15-20 days after first spray. The impact was evidenced with an accrued yield increase of 38.0 % over existing practice.

Cost of Technology

The cost of technology is ₹ 4,414/- ha^{-1} for two sprayings of Azoxystrobin 18.2% + Difenconazole 11.4% SC during crop growth period.

Impact and Benefit

The novel blended fungicide molecule Azoxystrobin 18.2% + Difenconazole 11.4% SC @ 500 ml ha^{-1} control the diseases blast and sheath in an economical way saving an expenditure of ₹ 854 ha^{-1} on crop protection with increased cost benefit ratio of 1:7.9. The novel combination fungicide with a broad spectrum of activity curtails multiple diseases of rice and its rapid uptake, translaminar and greater xylem mobility with in plant in spite with low residual toxicity reduces the diseases over existing widely used molecules such as Isoprothiolane and Propiconazole.

Field view of the experiment

Azoxystrobin + Difenconazole treated plot

Contact

Principal Scientist (Pl. Br.) & Head,
Institute of Rice Research, ARI,
Rajendranagar, Hyderabad - 500 030
Phone: 7337399470
psrice2009@gmail.com

18 Compatible Insecticide and Fungicide Blended Molecules for Management of Stem Borer and Blast in Rice

Field view of the experiment

Effect of Chlorantraniliprole and Picoxystrobin + Tricyclazole

Contact

Associate Director of Research,
Regional Agricultural Research Station
RARS, Polasa, Jagtial-505 529
Phone : 9989625213
Email: adr_rarsjgl@yahoo.com

Salient Features

In rice, yellow stem borer (*Scirpophaga incertulas)* and blast, (*Magnoparthe grisea)* are the two main biotic limitations that severely harm the rice crop and reduce the yield levels at a later stage of crop growth. Yield losses due to yellow stem borer and blast are estimated to 1-19% in early stages and 38-80 per cent at later stages of crop growth period. Therefore, a combined application of effective fungicides and insecticides is a practical necessity and they need to be compatible to retain the same level of effectiveness and to reduce the cost of plant protection.

Performance

In case of simultaneous recurrence of both stem borer and blast disease during the crop growth period, foliar application of Chlorantraniliprole18.5% SC @ 150 ml ha^{-1} and Picoxystrobin (78%) + Tricyclazole (20.33%) SC) @ 1000 ml ha^{-1} performed well with a per cent reduction of blast disease (13.85 %) and pest incidence of stem borer in terms of per cent dead hearts (2.06 %) and white ears (5.72 %). The additional yield gained was 1849 kg ha^{-1} with higher net returns (₹ 16,403) and B:C ratio of 2.84. Alternate combination of Chlorantraniliprole 18.5% SC @ 150 ml ha^{-1}+ (Tricyclazole 18% + Mancozeb 62 % WP @ 2.5 g L^{-1}) also yielded higher net profits (₹ 15,305) with marginal increase in benefit cost ratio of 2.90 with gain in yield of 1717 kg ha^{-1} by minimising both stem borer and blast incidence.

Cost of Technology

The cost of technology involving integration of insecticide and fungicide blended molecule Chlorantraniliprole 18.5% SC @ 0.3 ml L^{-1} and Picoxystrobin (78%) + Tricyclazole (20.33% SC) @ 2 ml L^{-1} was around ₹ 4,785 ha^{-1} and Chlorantraniliprole and Tricyclazole (18%) + Mancozeb (62 % WP) @ 2.5 g L^{-1}, the cost was ₹ 4,275 ha^{-1} as an alternative combination can be recommended based on the availability.

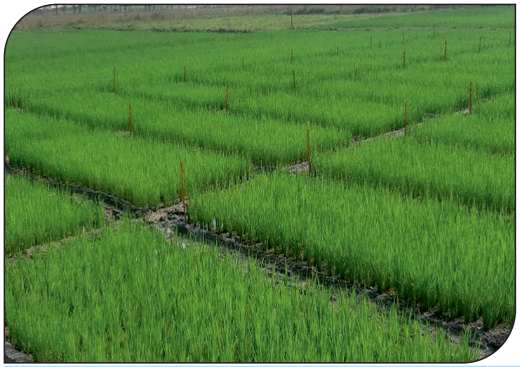
Impact and Benefit

Compatible combination of fungicides and insecticides was found promising for the simultaneous control of both insect pest and disease during crop growth period in terms of agroecosystem protection and reducing the cost of application. Combination of Chlorantraniliprole 18.5% SC @ 0.3 ml L^{-1} and Picoxystrobin (78%) + Tricyclazole (20.33% SC) @ 2 ml L^{-1}) can be recommended as tank mix to manage stemborer and blast incidence.

19 Management of Stem Borer and Leaf Folder in Paddy with New Molecules

Salient Features

Stem borer is the most important and devastating pest in rice causing yield losses up to 27-34 per cent every year. Very few insecticides are available in the market for efficient management of stem borer in rice crop. Recurrent usage of these insecticides may lead to development of resistance in insect pests. Therefore, it is essential to evaluate newer insecticides which has multiple mode of action for management of multiple pests. Novaluron (5.25 %) + Emamectin Benzoate (0.9 % SC) is such a molecule with dual mode of action which interferes with the neuromuscular process at nerve muscle junction and acts as chitin inhibitor causing abortive moulting in wide range of lepidopteron pests.



Field view of the experiment

Performance

Two foliar sprays of Novaluron (5.25%) + Emamectin Benzoate (0.9%) @ 500 ml ha^{-1} at 25-30 days after transplanting followed by spraying with Chlorantrniliprole 18.5 SC @ 150 ml ha^{-1} at an interval of 20 days after first spray has reduced leaf folder and white ear per cent by 69.0 and 73.0, respectively. Maximum yield of 4704 kg ha^{-1} was recorded which is 51.3 per cent increase over untreated control (3110 kg ha^{-1}) resulting in higher net returns (₹ 28,926) and B:C ratio (1.48).

Novaluron + Emamectin Benzoate treated plot

Cost of Technology

Cost of commercial formulation of Novaluron 5.25% + Emamectin Benzoate 0.9% @ 500 ml ha^{-1} is ₹ 1200/- whereas Chlorantraniliprole 18.5 SC cost is ₹ 2000 @ 150 ml ha^{-1}. Total cost of technology including spraying is ₹ 4200/- ha^{-1}.

Impact and Benefit

Rational use of Novaluron 5.25% + Emamectin Benzoate 0.9% @ 500 ml ha^{-1} lead to delay in resistance development in stem borer and leaf folder due to their two way mode of action. Foliar sprays of Novaluron 5.25% + Emamectin Benzoate 0.9% @ 500 ml ha^{-1} at 25-30 days after transplanting followed by spraying with Chlorantrniliprole 18.5 SC @ 150 ml ha^{-1} 20 days after first spray has reduced leaf folder and stem borer infestation.

Contact

Principal Scientist (Agro) & Head

Regional Sugarcane & Rice Research station
Rudrur, Nizamabad-503186
Phone : 9989625218
Email : rsrrs.head@gmail.com

20 Novel Insecticides for Multiple Pest Management in Soybean

Field view of the experiment

Chlorantraniliprole 8.8% + Thiomethoxam 17.5% SC for pest management in Soybean

Salient Features

Soybean is an important oilseed & leguminous crop of the world. Tobacco caterpillar and other defoliators are serious pests of soybean feeding on leaves and also damaging 30-50 per cent of the pods. Sucking pests like aphids and whitefly acts as vectors for soybean mosaic virus and yellow vein mosaic, respectively. Search for the newer and most effective insecticide combination for the management of both defoliators and sucking pests is essential to avoid the yield losses and to reduce expenditure on crop protection. Spraying of new generation pre-mixed insecticides like Chlorantraniliprole 8.8% + Thiomethoxam 17.5% SC sustain toxicity against spotted pod borer and bean aphid for a longer period with least possibility of resistance development with less mammalian toxicity.

Performance

The reduction of defoliators and sucking pests was observed by 83.2% and 76.8%, respectively by spraying insecticidal composition of Chlorantraniliprole 8.8% + Thiomethoxam 17.5% SC, @ 500 ml ha^{-1} twice during crop growth period at 30-35 days after sowing and second at 20 days after first spray promulgated in 63% increased yield of 63% (1473 kg ha^{-1}) over control (895 kg ha^{-1}). The above combination produced an additional net return of ₹ 30,000/-. with BC. Ratio of 1.63.

Cost of Technology

The cost of spraying insecticidal composition Chlorantraniliprole 8.8% + Thiomethoxam 17.5% SC @ 500 ml ha^{-1} twice at 30-35 days after sowing and 20 days after first spray including labour is ₹ 4,500/- ha^{-1}

Impact and Benefit

The cumulative effect of the synergistic insecticidal composition is superior to that of either of the single compound. The selective nature of this insecticidal composition greatly eliminates the risk to beneficial insects besides reduction of the defoliators and sucking pest complex.

Contact

Principal Scientist (Agro) & Head

Regional Sugarcane & Rice Research station
Rudrur, Nizamabad-503186
Phone : 9989625218
Email : rsrrs.head@gmail.com

21 Management of Fall Army Worm (FAW) in Maize

Salient Features

The fall army worm *Spodoptera frugiperda* is a notorious polyphagous pest, mainly attacking maize. The pest is highly migratory causing sudden outbreaks and economically destructive threatening maize production. A short life cycle of FAW with multiple generations in one season may result in reinfestation of the same during crop growth period may lead to resistance evolution against insecticides. Timely application of suitable insecticides in proper dose at early stages of crop for the control of fall army worm is important for achieving higher yield of maize.

Field view of the Experiment

Performance

Two sprayings of Chlorantraniliprole 18.5 % SC @ 0.4 ml L^{-1} or Spinetoram 11.7 % w/w SC @ 0.5 ml L^{-1} on maize at 7 and 14 days after planting provided an effective control of fall army worm and gave yield advantage of 47.33 q ha^{-1} with Chlorantraniliprole and 44.93 q ha^{-1} with Spinetoram over untreated control (44.93 q ha^{-1}). The net profits range from ₹ 89,028 (Chlorantraniliprole) to 84,501 (Spinetoram) and the B:C ratio was higher (1.32) with Chlorantraniliprole under assured irrigated conditions during *vanakalam* and *yasangi* seasons.

Fall army worm damage in maize

Cost of Technology

The cost of application of two sprays of Chlorantraniliprole 18.5% SC @ 0.4 ml L^{-1} was ₹ 3,393/- and for Spinetoram 11.7% w/w SC @ 0.5 ml L^{-1} is ₹ 4,310/- ha.

Impact and Benefit

Spraying of Chlorantraniliprole 18.5% SC @ 0.4 ml L^{-1} at 7 and 14 days after germination was found effective in controlling the incidence of FAW with highest yield and profitability (1.32 B:C ratio) of maize followed by spraying of Spinetoram 11.7% w/w SC @ 0.5 ml L^{-1} over untreated control.

Effect of Chlorantraniliprole in maize

Contact

Principal Scientist (Pl. Br.) & Head
Maize Research Center,
ARI, Rajendranagar – 500 030
Phone :8008404874
Email: mrcari@redifmail.com

22 Boll Rot Management in Cotton

Field view of the Experiment

Kresoxymethyl treat plot

Salient features

Cotton is one of the major cash crops of global significance and it is one of the most important fiber and cash crop of India. In Telangana also it occupies sizable area and plays a dominant role in the industrial and agaricultural economy of the country. The productivity of the cotton crop have been limited by major diseases and among them boll rot disease plays an important role. The disease was prevalent in cotton growing areas of Telanagana state and an approach for management of boll rot was evaluated with the newer molecules for efficient disease management to increase kapas yield.

Performance

The fungicidal spraying of Kresoxymethyl 44.3% @ 500 ml ha^{-1} resulted in minimum boll rot disease index (5.49%) with increased kapas yield of 2265 kg ha^{-1} and realized an additional returns of ₹ 55,000/- with the benefit cost ratio of 1.89 in NTZ (RARS, Adilabad).

In CTZ (RARS, Warangal) application of Kresoxymethyl 44.3% @ 500 ml ha^{-1} and the next best alternative combination of fungicide and organic compound ie., copper oxychloride 50% WP @ 1500 g ha^{-1} + salicylic acid (500 ppm) ha^{-1} showed minimum per cent disease index of 8 with higher yield (2748 kg ha^{-1}) and additional returns of ₹ 55,000. However, the benefit cost ratio (1.89) is higher with Kresoxymethyl 44.3% followed by 1.87

Cost of Technology

The cost of foliar spray of the fungicide Kresoxymethyl 44.3 % @ 1 ml L^{-1} is1464 ha^{-1} and for combination of Copper oxychloride 50 % WP @ 3 g + Salicylic acid (200 ppm) is ₹ 2,277 ha^{-1}.

Impact and Benefit

Spraying of single molecule Kresoxymethyl showed an additional yield of 529 - 824 kg ha^{-1} in different zones of Telangana over control with higher bioefficacy of translaminar movement with protective and curative disease control. In RARS Warangal, combination of Copper oxychloride + Salicylic acid is also effective in control of boll rot in cotton.

Contact

Associate Director of Research,
Regional Agricultural Research Station,
CTZ, Mulugu Road, Warangal.
Phone: 0870-2100236
Email:adrras_wgl@yahoo.co.in

Prinicipal Scientist (Agro) & Head,
Agricultural Research station,
Adilabad, Telangana
Phone : 9908556659
Email: arsadilabad1@gmail.com

23 Management of Sterility Mosaic Disease in Pigeonpea

Salient Features

Sterility Mosaic Disease *ie.,* the "Green Plague" of Pigeonpea is one of the most damaging disease that infect at an early stage resulting in 95-100% yield loss. This disease spread by a mite (*Aceria cajani)* which results in complete or partial cessation of flower production. Hence, a suitable and cost effective management approach is essential to mitigate the losses caused by sterility mosaic disease. Off late new acaricides *viz*., Fenpyroximate and Hexythiasazox were identified for effective management of disease.

Performance

Sterility mosaic disease in pigeonpea was found to be reduced with pre seed treatment with Imidachloprid 70% WS @ 120 g ha^{-1} seed + foliar spray of fenpyroximate 5 EC @ 50 ml ha^{-1} at 45 to 60 days age of crop growth period with this practice, minimum per cent disease incidence (22.1) and maximum disease reduction (61) was observed resulting in proportionate (85%) increased yield (2299 kg ha^{-1}) over control treatment and net returns of ₹ 1,23,972 ha^{-1} with a B:C ration of 4.4. with minimum per cent disease incidence (22.1%) and maximum percent disease reduction of 61% which results in proportionate 85% increase of yield 2299 kg ha^{-1} and net returns of ₹ 1,23,972 ha^{-1} with B:C ratio of 4.4.

Cost of Technology

The cost of seed treatment with Imidachloprid 70% WS @ 120 g ha^{-1} seed + foliar spray of fenpyroximate 5 EC @ 50 ml ha^{-1} was ₹ 1,760 ha^{-1}.

Impact and Benefit

Optimization of active ingredient (a.i.) of insecticide application in the form of seed treatment with Imidacloprid 70% WS @ 5g kg^{-1} seed followed by foliar spray with fenpyroximate 5 EC @ 0.1% at maximum vegetative stage was found beneficial not only in terms of control of sterility mosaic disease but also on yield (1651 kg ha^{-1}) with benefit cost ration of 1:4.4.

Field view of the experiment

Effect of Imidacloprid + fenpyroximate on pigeonpea

Contact

Associate Director of Research,
Regional Agricultural Research Station,
CTZ, Mulugu Road, Warangal.
Phone: 0870-2100236
Email:adrras_wgl@yahoo.co.in

ANNEXURE - Agro Technologies for the year 2022-23

Sl.No	Technology	Research Station and Scientists Contributed
1	Standardization of Nitrogen Levels and its Time of Application in Dry Converted Wet Rice	**RARS, Jagtial,** Dr. D. Sreelatha, Dr. E. Rajinkanth, Dr. P. Revathi, Dr. A. Krishna Chaithanya
		RARS, Warangal Dr. U. Nagabhushanam, Dr. Ch. Ramulu
		RS & RRS, Rudrur Firdous Sahana, Dr. B. Balaji Naik, B. Soundarya
2	Weed Management in Wet Direct Seeded Rice (W-DSR)	**RARS, Jagtial** Dr. D. Sreelatha, Dr. E. Rajinkanth, Dr. P. Revathi, Dr. A. Krishna Chaithanya
		RARS, Warangal Dr. U. Nagabhushanam, Dr. P. Raghu Rami Reddy
		RARS, Palem Dr. K. Shridhar, Dr. N. Nalini, Dr. D. Vijayalakshmi, Dr. M. Venkata Ramana
		ARS, Kunaram Mr. D. Anil, Dr. P. Raghu Rami Reddy, Dr. M. Venkata Ramana, Dr. Sreedhar Siddi
3	Weed Management in Dry Direct Seeded Rice (D-DSR)	**RARS, Jagtial** Dr. D. Sreelatha, Dr. E. Rajinkanth, Dr. P. Revathi, Dr. N. Mahesh, Dr. P. Ravi
		RARS, Palem Dr. K. Sridhar, Dr. N. Nalini, Dr. D. Vijayalakshmi, Dr. M. Venkata Ramana
		ARS, Kunaram Mr. D. Anil, Dr. P. Raghu Rami Reddy, Dr. M. Venkata Ramana, Dr. Sreedhar Siddi
4	Integrated Weed Management in Cotton based Intercropping Systems	**AICRP on Weed Management, Rajendranagar** Dr. B. Padmaja, Dr. T. Ram Prakash, Dr. M. Madhavi
5	Profitable Maize based Vegetable Cropping Sequence for Northern Telangana Zone	**ARS, Karimnagar** Dr. P. Madhukar Rao, Dr. E. Rajanikanth, Dr. G. Manjulatha
6	Crop Diversification after *kharif* Dry DSR for higher Productivity, Profitability and Resource Use Efficiency under Different Tillage Practices	**RARS, Jagtial** Dr. E. Rajanikanth, Dr. P. Madhukar Rao, Dr. D. Sreelatha, Dr. N. Mahesh, Dr. G. Sreenivas
		RARS, Warangal Dr. U. Nagabhushanam, Dr. P. Raghu Rami Reddy

ANNEXURE - Agro Technologies for the year 2022-23

Sl.No	Technology	Research Station and Scientists Contributed
		RARS, Palem: Dr. M. Parimal Kumar, Smt. K. Mamatha, Dr. M. Malla Reddy
		ARS, Kunaram Mr. D. Anil, Dr. P. Raghu Rami Reddy, Dr. M. Venkata Ramana, Dr. Sreedhar Siddi
		ARS, Tornala Dr. D. Swetha, Dr. S. Sridevi, Dr. N. Sanianth, Dr. A. V. Ramanjaneyulu
7	Rain Water Harvesting through Farm Ponds- A Climate Resilient Technology for Sustainable Crop Production in Drylands	**ARS, Tornala** Dr. S. Sridevi, Dr. A. V. Ramanjaneyulu, Dr. N. Sainath, Dr. D. Swetha
8	Climate Smart IFS Model for Irrigated Dry (ID) Areas of Telangana	**AICRP on IFS, Rajendranagar** Dr. M. Goverdhan, Dr. M. Venkata Ramana, Dr. Ch. Pragathi Kumari, Dr. G. Kiran Reddy, Dr. S. Sridevi
9	Planting Geometry, Nitrogen Nutrition and Cutting Management for Higher Fodder Productivity of Moringa (*Moringa oleifera*)	**AICRP on Forage crops and Utilization, R'nagar.** Dr. RVT. Balazzii Naaiik, Dr. T. Sukruth Kumar, B. Murali, Dr. T. Shashikala
10	Nitrogen and Cutting Management for Higher Productivity of Multicut Forage Pearlmillet	**AICRP on Forage crops and Utilization, R'nagar.** Dr. RVT. Balazzii Naaiik, Dr. T. Sukruth Kumar, B. Murali, Dr. T. Shashikala
11	Gypsum - A Better Source for Enhancing the Productivity of Sunflower in Sulphur Deficient Soils	**ARS, Tornala** Dr. N. Sainath, Dr. S. Sridevi, Dr. D. Swetha, Dr.A.V.Ramanjaneyulu
12	Soil Test Based Fertilizer Prescription for Targeted Yield of Soybean in Vertisol	**RS&RRS, Rudrur** Dr. T. Prabhakar Reddy, Dr. A. Madhavi, Dr. T. Srijaya, Mrs. B. Manju Bhargavi, Dr. D. Vijaya Lakshmi, Mr. J. Ravinder, Mrs. N. Swapna, Dr. A. Krishna Chaitanya
13	Fertilizer Requirement for Irrigated Cotton in Alfisols	**RARS, Palem** Dr. D. Vijaya Lakshmi, Dr. K. Sridhar, Dr. M. Goverdhan
14	Distellery Spent Wash an Effluent from Sugar Mills Increase the Growth and Yield of Sugarcane	**ARS, Basanthpur** Dr. M. Vijay kumar, G. Vijayalakshmi
15	Selective Mechanization for Higher Productivity of Sunflower Cultivation in Alfisols	**ARS, Tornala** Dr. D. Swetha, Dr. S. Sridevi, Dr. N. Sanianth, Dr. A. V. Ramanjaneyulu

ANNEXURE - Agro Technologies for the year 2022-23

Sl.No	Technology	Research Station and Scientists Contributed
16	Cotton Residue Management for Higher Productivity of Succeeding Crops	**ARS, Karimnagar** Dr. G. Manjulatha, Dr. E. Rajanikanth, Dr. P. Madhukar RaoDr. P. Ravi **RARS, Palem** Dr. K. Sridhar, Dr. M. Parimal Kumar, Dr. D. Vijayalaxmi, G. Kiran Reddy, Dr. S. Triveni, Dr. M. Venkata Ramana **RARS, Jagtial** Dr. N. Navatha, Dr. E. Rajanikanth, Dr. P. Ravi **RARS, Warangal** Dr. B. Madhavi, Dr. Ch. Ramulu, Dr. G. Kiran Reddy and Dr. G. Santhosh Kumar
17	Multiple Disease Management with Novel and Broad Spectrum Combination of Fungicides in Rice	**IRR, Rajendranagar** Dr T. Kiran Babu, Dr N. Ram Gopala Varma and Dr P. Raghu Rami Reddy
18	Compatible Insecticide and Fungicide Blended Molecules for Management of Stem Borer and Blast in Rice	**RARS, Jagtial** Dr S. Omprakash, Dr N. Balram
19	Management of Stem Borer and Leaf Folder in Paddy with New Molecules	**RS&RRS, Rudrur** M. Saicharan, Y. Swathi, B. Soundarya, Dr M. Sridhar, Dr B. Balaji Naik
20	Novel Insecticides for Multiple Pest Management in Soybean	**RS&RRS, Rudrur** M. Saicharan, Y. Swathi, G. Praveen kumar, Dr M. Sridhar, Dr B. BalajiNaik
21	Management of Fall Army Worm (FAW) in Maize	**MRC, Rajendranagar** Dr K. Vani Sree, Dr M. Lava Kumar Reddy, Dr B. Mallaiah, Dr M. V. Nagesh Kumar, Dr D. Bhadru, Dr D. Srilatha, Dr Y. Siva Lakshmi
22	Boll Rot Management in Cotton	**ARS, Adilabad** Dr K. Rajashekar, Dr. N. Balram **RARS, Warangal** D. Ashwini, Dr G. Padmaja, Dr B. Ram Prasad
23	Management of Sterility Mosaic Disease in Pigeonpea	**RARS, Warangal,** Dr G. Padmaja, Dr D. Veeranna, Dr. N. Sandhya Kishore, Dr M. Madhu

HDPS cotton sown with pneumatic planter

Device to manage Head Load - To Reduce Drudgery of Women

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पेटेंट प्रमाण पत्र | Patent Certificate
(पेटेंट नियमावली का नियम 74) | (Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No. : 504641

आवेदन सं. / Application No. : 202141055207

फाइल करने की तारीख / Date of Filing : 29/11/2021

पेटेंटी / Patentee : 1.PROFESSOR JAYASHANKAR TELANGANA STATE AGRICULTURAL UNIVERSITY 2.MARUT DRONETECH PRIVATE LIMITED

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित *METHOD AND SYSTEM OF DISPENSING MULTI-VARIED SEEDS THROUGH MULTI NOZZLE AERIAL SEED DISPENSING DEVICE* नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख नवम्बर 2021 के उन्तीसवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled *METHOD AND SYSTEM OF DISPENSING MULTI-VARIED SEEDS THROUGH MULTI NOZZLE AERIAL SEED DISPENSING DEVICE*as disclosed in the above mentioned application for the term of 20 years from the 29th day of November 2021 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख / Date of Grant : 30/01/2024

पेटेंट नियंत्रक
Controller of Patents

Note. - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 29th day of November 2023 and on the same day in every year thereafter.

▲ **Rice seeding device (wet direct seeding) attachment to Drone**

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