AGRO TECHNOLOGIES

2021-22

Natural Resource Management, Crop Production, Crop Protection and Farm Mechanisation

Professor Jayashankar Telangana State Agricultural University

Rajendranagar, Hyderabad - 500 030, Telangana State, India.

www.pjtsau.edu.in

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Publication No. : 31/BL/PJTSAU/2023
Agro Technologies 2021-22

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No. of Copies : 500

Year of Publication : 2023

Printed at :
PJTSAU Press, ARI Campus
Rajendranagar, Hyderabad - 30, Telangana State

Published by :
Professor Jayashankar Telangana State Agricultural University
Rajendranagar, Hyderabad - 30, Telangana State

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FOREWORD

Agriculture plays a pivotal role in the economic development of a State. As more than 60 per cent of the rural population of Telangana is employed in Agriculture and its allied activities, inclusive growth of this sector can address not only the hunger and malnutrition of the population but also other challenges including poverty, water and climate change. Agricultural sector of Telangana is a major contributor to the GSDP as the Gross state value added of the Agriculture and allied sector has seen a growth of 186% from its formation. To sustain and for growth of this sector, Agricultural technologies plays an important role.

PJTSAU played a significant role in developing and disseminating various Agro technologies that include improving the efficacy of farmland by halting or reversing deteriorating soil health, encouraging crop diversification, practicing sustainable water management, protected cultivation, Farm machinery etc. The sustainable development goals have been the driving force for the agro technologies being rolled out by the University to ensure idealistic growth pattern even in the face of adversities. Authentication and validation enabled by a research audit system through multiple check points has enabled the university to reach and experience the present progress.

The University believes in maintaining the momentum of an optimum work ecosystem created with competent human resources and state of art research infrastructure to tackle emerging field constraints in farming in a dynamic mode. I hope this publication **"Agro Technologies 2021-22"** 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 document.

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PREFACE

Agriculture is the foundation of any economy and it is critical to feed the growing population. Furthermore, raising food demand necessitates farming to develop new methods of enhancing output and efficiency. As a result, the new emerging agro-technologies become the solution for farmers to overcome various operational challenges. With the adoption of many such new advent agro-technologies, the state has witnessed significant increase in productivity of many crops and stood as largest producer of major crops in the country.The state is witnessing currently justifying the cause of "Research with Societal Relevance". Manifestation of these solutions has been realized in the form of huge productivity gains in major crops, economizing the production process, protecting the environment and above all ensuring remunerative returns to the practicing farmers to lead further on a strong platform with confidence and certainty.

Dynamic and solutions based technology packages involving interdisciplinary efforts have exhibited collateral benefits ensuring environmental safety, enhanced water, fertilizers and crop protection chemicals use efficiency and mechanization of selective crop production leading to sustainability

PJTSAU through various research facilities has been constantly endeavoring to design and develop cost effective, farmer friendly technologies duly factoring the feedback from extension outreach machinery and other stakeholders including the end users. Scientists are being encouraged to work across the disciplines and institutions in a participatory approach to develop technologies and fine - tune them in resolving emerging issues like climate change, ecosystem changes, shifts in economic priorities in a given time line.

This compendium **"Agro Technologies 2021-22"** contains such innovations aimed at consolidating the gains accrued in the agricultural scenario of the state on a sustainable basis covering natural resource management & crop production, crop protection and farm mechanization aspects of farming. I hope it will serve as a valuable reference for the farm fraternity striving for improving the state of the farmer. I extend my appreciations to all the contributing Scientists and the staff who are involved in bringing this compilation in the present form.

P. Raghu Rami Reddy

Machine Transplanting is the Profitable Way of Rice Establishment

Salient Features

Rice, a global food crop, is extensively grown both in India and world. The major cost goes to transplanting in rice production which is a time bound operation and require huge labour. Conventional rice need 25–30 man-days for transplanting one hectare. The labour shortage due to migration/industrialisation, drudgery and rising wage rates during peak and short transplanting time demand move towards mechanisation as it facilitate timely planting and better crop yield and profits.

Performance

Establishing rice through machine transplanting with 15 days old seedlings recorded higher grain yield (6595 kg ha^{-1}) which was 8.4 % higher to manual transplanting (6081 kg ha^{-1}) with 25 days old seedlings. The different varieties, JGL 24423 (6545 kg ha^{-1}), KNM 118 (6347 kg ha^{-1}) and RNR 15048 (6002 kg ha^{-1}) recorded almost similar grain yield under machine transplanting. Machine planting gave higher economic returns over conventional transplanting. The net returns (₹ 92990 ha^{-1}) and B:C ratio (2.56) was higher with JGL 24423 when the crop was transplanted with the machine transplanter.

Machine transplanting of different rice varieties

Performance of the crop in machine tranplanting method

Cost of Technology

The cost of conventional transplanting was around ₹ 10000 ha^{-1}, which was 37.5% more than the machine transplanting. The net returns were increased by ₹ 7500 ha^{-1}.

Impact and Benefit

Machine transplanting is the alternative methods of rice establishment over conventional manual transplanting, particularly under the conditions of acute labour shortage. Large areas can be planted within a short span of time with this technology, besides higher yields and net returns.

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Optimum Date of Sowing and Drip Fertigation for Higher Yield in Rabi Mustard

Salient Features

Mustard is an important *rabi* oil seed crop and is gaining momentum in Telangana. Drip fertigation could be a viable strategy for improving nutrient and water use efficiency. The use of water soluble fertilizers in conjunction with micro irrigation systems saves labour, while increasing use efficiency of both water and nutrients.

Performance

The performance of mustard in paired row (80/40 cm x 15 cm) system during *rabi* season was higher with 15th October (1257 kg ha^{-1}) and 1st November (1215 kg ha^{-1}) dates of sowing. Drip fertigation @ 125% RDNK (75: 50 N-K_2O kg ha^{-1}) from 15 DAS to pod development stage (80 DAS) at four days interval recorded higher seed yield (1305 and 1040 kg ha^{-1}), net returns (₹ 35,425 and ₹ 18754 ha^{-1}) and B:C ratio (2.52 and 1.72) at WTC, Hyderabad and at RARS, Jagtial, respectively. Scheduling of irrigation at 1.20 Epan (912 kg ha^{-1} and ₹ 20382) showed 11.0 and 13.4% and 20 and 30.4% higher yield and net returns over drip irrigation at 1.0 Epan and 0.8 Epan with a B:C ratio of 1.99 at RARS, Jagtial.

Mustard crop sown on 15th October with 150 % RDNK

Performance of mustard crop sown on 1st November

Cost of Technology

The cost of additional fertlizers was ₹ 1470 (25 % N & K) excluding the cost of drip irrigation.

Impact and Benefit

The higher yield and profits of mustard can be achieved through drip fertigation and rrigation with 125% RDNK and irrigation at 1.20 Epan with B:C ratio of 2.52 and 1.72 at Southern and Northern Telangana zones of Telangana.

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Optimum Seed Rate and Spacing for Higher Fodder Production of Hedge Lucerne

Performance of Hedge lucerne at different seed rates and spacings

Salient Features

Hedge Lucerne (*Desmanthus virgatus* L.) is a popular perennial legume crop among dairy, goat and sheep rearing farmers. The crop comes up well under marginal soils even under rainfed conditions and its green fodder is highly nutritious with more than 15% crude protein content. Seed cost of hedge lucerne is very high and it is approximately 15 to 20 % of total cost of cultivation.

Performance

Cultivation of hedge lucerne at a seed rate of 15 kg ha^{-1} in solid rows with 60 cm inter row spacing produced higher fodder yield (48.71 t Green Fodder, 9.23 t Dry Fodder) and crude protein (1.56 t ha^{-1}). It was found remunerative with a B:C ratio of 2.90 and net return of ₹ 1,27,487 ha^{-1} compared to farmers practice of broad casting seed @ 20 kg ha^{-1} (2.39; ₹ 93,539 ha^{-1}).

Hedge lucerne sowing @ 15 kg ha^{-1} seed rate with 60 cm X solid rows

Cost of Technology

The cost of the technology (seed rate of 15 kg ha^{-1}and sowing in 60 cm apart) was lower than that of farmer practice (20 kg ha^{-1}) as it reduces seed rate by 5 kg ha^{-1}.

Impact and Benefit

Cultivation of hedge lucerne grown at 60 cm apart in solid rows with 15 kg ha^{-1} of seed rate reduces seed rate by 5 kg ha^{-1} with a saving of ₹ 4500 in cost of cultivation. This agronomic practice is highly remunerative as against farmers practice.

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Bio Fortification with Zinc and Iron for Improving the Quality of Annual Cereal (Maize and Sorghum) Fodder Crops

Salient Features

Bio fortification or biological fortification refers to nutritionally enhanced food crops with increased bioavailability to human beings or animals. This can be achieved through plant breeding, agronomic and biotechnology approaches. Agronomic bio fortification of crops with micronutrients is gaining importance owing to increased awareness about balanced nutrition. The nutrition of animals with bio fortified fodder aims at providing the right quantity of micronutrients such as Zn, Fe, Cu, Se and Iodine that in turn improves animal growth, development and health.

Field view of Bio fortified (zinc and iron) sorghum crop

Performance

Bio fortification of fodder maize and fodder sorghum by application of $ZnSO_4$ @ 20 kg ha^{-1} to the soil + 1% foliar spray and $FeSO_4$@ 20 kg ha^{-1} to the soil + 1% foliar spray at 45 DAS along with recommended dose of fertilizers (maize–100:50:30 and sorghum –100:40:30 N:P_2O_5:K_20 kg ha^{-1}) produced highest green fodder yield of maize (30.1 t ha^{-1}) and sorghum (26.2 t ha^{-1}). The application of these micro nutrients improved both Zinc and Iron content in fodder sorghum (88.5 ppm and 580 ppm) and maize (102.5 ppm and 609 ppm) over control plot (sorghum: 41.5 ppm and 230 ppm; maize: 46.0 ppm and 252 ppm).

Field view of Bio fortified (zinc and iron) maize crop

Cost of Technology

Application of $ZnSO_4$ and $FeSO_4$ each @ 20 kg ha^{-1} followed by 1% spray of $ZnSO_4$ and $FeSO_4$ at 45 DAS requires an additional cost of ₹ 2000/-.

Impact and Benefit

With minimum investment of ₹2000/- ha^{-1}, the micronutrient (Zinc and Iron) content of the fodder crops (maize and sorghum) can be significantly improved and achieved benefit cost B:C ratio of 1.7 and 1.6 with biofortification of fodder maize and sorghum with micronutrients (Zn & Fe).

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Integrated Use of Bio fertilizers, Organic Manures and Inorganic Fertilizers on Growth and Yield of Winter Maize

Salient Features

Maize (*Zea mays* L.) is the third most important grain crop in India after rice and wheat. Because of its diverse uses in the feed industry and food sectors, maize is considered as an internationally important commodity driving world agriculture. Modern agricultural practices emphasized widespread use of fertilizer and inturn increased grain yield. However, long term use of chemical fertilizers adversely affected soil chemical, biological and physical properties causing nutrient imbalance resulting in plateauing yields. Integrated nutrient management which embraces judicial combination of organic and biofertilizers to supplement chemical fertilizers and maintain soil fertility for sustaining yields.

Performance

In red sandy loam soils, integrated use of biofertilizers, organic manures & inorganic fertilizers on winter maize produced significantly higher grain yield (9392 kg ha^{-1}) and B:C ratio (2.32) with application of FYM @10 t ha^{-1} + Azospirilum + PSB soil application & seed treatment in addition to recommended dose of fertilizer (240:80:80 N: P_2O_5:K_2O kg ha^{-1}). All the integrated treatments involving 100% RDF were found superior to that of application of 75% RDF along with organic manures and biofertilizers. The PSB activity (83×10^5 to 149×10^5) and dehydrogenase (0.232 to 0.368 mg TPF g^{-1}) were higher in all treatments with integrated use of biofertilizers, organic manures and inorganic fertilizers.

Performance of winter maize with Integrated Nutrient Management

Cost of Technology

An additional cost of ₹ 17625/- ha^{-1} is required to supply biofertilizers (₹ 625/- ha^{-1}) and FYM @10 t ha^{-1} over and above the cost of inorganic fertilizers.

Impact and Benefit

The integrated use of biofertilizers, organic manures and inorganic fertilizers has not only increased 7 % of the winter maize grain yield (654 kg ha^{-1}) over inorganic fertilizer application alone but also, increased the soil microbial activity. This technology would be the effective strategy in achieving the required productivity on sustainable basis.

Performance of winter maize with FYM@ 10 t ha^{-1} + 100% RDF+Biofertilizers

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Management of Maize Crop Residue and Optimisation of Fertilizer Levels on Succeeding *Rabi* Crops

Salient Features

Maize stover can be effectively utilized as animal fodder for biogas production instead of burning. However, returning residues directly to the field has been promoted as a source of organic matter and to some extent restores soil fertility. The harvesting of *kharif* maize crop with harvester leaves around 6-8 t ha^{-1} of stubbles on the ground. The farmers practice of burning the stubbles for taking up sowing of succeeding crop is resulting in nutrient loss as well as oxidation of organic carbon and loss of microbial flora. The restitution of crop residue and the choice of tillage system seems to be highly dependent on the pedo-climatic conditions. The present technology involving crop residue management of maize and fertilizer levels on succeeding *rabi* crops is developed for achieving sustainable yields in maize based cropping system.

Zero tilled field

Performance

Higher maize equivalent yield (10,525 kg ha^{-1}) of the maize based system was achieved with conventional tillage including removal of previous maize stubbles as fodder and ploughed with cultivator and rotovator and was *on par* with other residue management treatments (incorporation of maize residue by rotovator or with disc harrow or ploughed with cultivator or no till treatment). The net returns and B:C ratio were higher with no till treatment (₹ 57,367 ha^{-1} and 1.53 respectively) and it was *on par* with all other residue treatments. Significantly higher system maize equivalent yield and net returns were recorded with maize-maize and maize-greengram systems with 100% RDF (14093 and 9119 kg ha^{-1}, respectively) than maize-maize and maize-greengram systems with 75% RDF (13097 and 8577 kg ha^{-1}, respectively). While, the B:C ratio was significantly higher with maize-greengram system with 100 % RDF (1.60) and was on par with maize-maize with 100 % RDF (1.59).

Mechanized harvesting of maize

Cost of Technology

The cost of preparatory cultivation with no till can be reduced by ₹ 5000 ha^{-1} and it also facilitates timely sowing of *rabi* crop.

Impact and Benefit

The farmer can take up *rabi* crops under no till conditions or incorporate maize stalk with rotovator without any reduction of productivity. It also facilitates timely sowing of *rabi* crops in maize-maize and maize-greengram systems with highest net returns and B:C ratio with 100% RDF.

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Drip Irrigation Schedule for Coloured Capsicum Varieties under Green Shade Net

Salient Features

Capsicum (*Capsicum annuum*) is also known as bell pepper or sweet pepper or *Shimla* mirchi which is one of the popular vegetable, rich in Vitamin A, C and minerals like Ca, Mg, P and K. Though it is a cool season crop, it can be grown round the year using protected structures and shade nets that minimize the damage of insect pests and diseases thereby improving the quality and yield compared to open cultivation. Coloured capsicums are in great demand in urban markets. Micro irrigation systems particularly drip irrigation in shade nets increase the water productivity and fruit yield of capsicum.

Performance

Coloured capsicum variety Indra (green) grown under green shade net (50% shade and tape type) during *rabi* season, recorded higher fresh fruit yield (46.4 t ha^{-1}) than Bomby (Red) (37.9 t ha^{-1}) and Orobelle (Yellow) (34.8 t ha^{-1}) with recommended dose of fertilizer (250:100:150 kg N-P_2O_5-K_2O ha^{-1}). The recommended water requirement of the coloured capsicum cultivated under green shade net and drip irrigation scheduled at 1.0 Epan was 2.91, 5.21, 3.60 and 3.66 L m^{-2} day^{-1} from planting to flower initiation (50 days), flowering to fruit initiation (20 days), fruit initiation to first picking (20 days) and first picking to last picking (88 days), respectively and recorded highest fresh fruit yield (48.4 t ha^{-1}) with 643.9 mm of water and achieved water productivity of 75.1 kg ha mm^{-1}.

General view of the Capsicum grown under Green shade net

Different coloured capsicum varieties

Cost of Technology

The cost of growing coloured capsicum varieties under green shade net technology ₹ 51,120 to ₹ 53,650/- ha^{-1} depending on the variety, its operational costs (seed, fertilizer and irrigation) excluding cost of shade net and drip irrigation system.

Impact and Benefit

The technology of growing capsicum variety Indra in green shade net (50 % shade and tape type) resulted in higher yield (22.4 and 33.3 %, respectively) than red and yellow coloured capsicum grown under drip fertigation scheduled at 1.0 Epan along with recommended dose of fertilizer and achieved B:C ratio of 2:1.

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Drip Irrigation and Fertigation Schedules for *Rabi* Brinjal

Salient Features

Brinjal or egg plant (*Solanum melongena* L.) is one of the most common and popular vegetable crop grown in India. India is the leading country next to China in the production of brinjal. Drip fertigation is an innovative approach for water and nutrient management as nutrients and water are applied directly to the soil which improves both nutrient and water use efficiency.

Performance

Brinjal (Kanakadurga Hybrid) transplanted during first fortnight of October produced higher fresh fruit yield (42 t ha^{-1} in 7 pickings) with drip irrigation scheduled at 1.0 Epan and fertigation of 100 % recommended dose of nitrogen and potassium (RDNK) (150 and 90 kg N and K_2O ha^{-1}) @ 1.71, 1.80 & 0.64 kg N ha^{-1} day^{-1} and 1.03, 1.08 & 0.39 kg K_2O ha^{-1} day^{-1} during 10 to 45 DAT, 45 to 70 DAT and 70 to 140 DAT, respectively at three days interval in 33 splits and 90 kg P_2O_5 as basal with highest water productivity (4.45 t m^{-3}). It was onpar with 1.2 Epan along with 100 or 120 % RDF (41.7 t ha^{-1}). The lowest yield (32.5 t ha^{-1}, in 7 pickings) was attained in the treatment where drip irrigation was scheduled at 0.8 Epan along with 80 % RDN & K.

Performance of Brinjal under drip fertigation

Drip Fertigation at 1.0 Epan and 100 % RDN & K

Cost of Technology

The cost of cultivating *rabi* brinjal under drip fertigation @ 1.0 Epan and 100 % RDNK was ₹ 25,800 ha^{-1} (includes cost of fertilizers, water and their application) excluding drip irrigation system.

Impact and Benefit

This technology resulted in 29.2 % increased fresh fruit yield and net returns (₹ 1,88,000) of *rabi* brinjal under drip fertigation with 1.0 Epan and 100 % RDNK with only 796.7 mm of applied water and achieved B:C ratio of 2.3. It might have supplied nutrients precisely minimizing the nutrient losses and increased nutrient use efficiency and quality of produce.

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Drip Fertigation schedule for *Rabi* Capsicum under Different Coloured Shade nets

Salient Features

Capsicum is a cool season crop, but it can be grown round the year using protected structures where temperature and relative humidity can be manipulated. Coloured shade nets substantially improve vegetative growth and fruit quality by minimizing the impact of biotic and abiotic stress. They are intensively used because of their ability to control the spectra of radiation so as to get different light induced effects on the plants, like increasing the fruit size and decreasing the duration of the production period. There is limited information on off season cultivation of vegetables under protected cultivation in Telangana. This technology will provide optimum drip fertigation and suitable coloured shade net for obtaining higher yield and quality capsicum during *rabi* season.

Performance

Capsicum (Indra) grown under red coloured shade net (50 %, mono x mono) under drip fertigation with 0.8 Epan with application of 150 % RDF (375-150-281.25 kg N-P_2O_5-K_2O ha^{-1}) in 50 splits during *rabi* season gave higher fresh fruit yield of 93.11 t ha^{-1} followed by white (81.33) and black (55.75) coloured shade nets, respectively. Drip irrigation scheduled at 0.8 Epan was found to be better in all the shade nets with 570 mm of water. Fertigation schedule was recommended in differential dosages of 1.63, 2.95, 6.32 and 1.01 kg N ha^{-1}day^{-1}, 1.03, 0.8, 0.9 and 0.62 kg P ha^{-1}day^{-1} and 0.9, 2.40, 4.95 and 0.62 K ha^{-1}day^{-1} during 10-45, 46-60, 61-70 and 71-220 DAT(days after transplanting) respectively.

Capsicum (Indra) under black shade net

Capsicum (Indra) under white shade net

Capsicum (Indra) under red shade net

Cost of Technology

The cost of technology was ₹40,900/- (includes cost of fertilizers and their application excluding cost of shade nets and drip system) under three coloured shade nets (white, black and red).

Impact and Benefit

The red coloured shade net provided favorable mean weekly temperature (27.1˚C) along with mean weekly relative humidity (45.18 %), light intensity (15891.8 LUX) and increased the fruit yield of Rabi capsicum by 14.48 % compared to conventional white coloured shade net and achieved B:C ratio of 3.85.

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Drip Fertigation Schedule in *Rabi* Cabbage

Salient Features

Cabbage is a popular cool season vegetable crop and is a rich source of vitamin A, B & C and minerals like phosphorus, potassium, calcium, sodium and iron. It is the second most important cole crop after cauliflower and is highly responsive to fertilizer application. Drip fertigation is the most efficient system for growing vegetable crops with effective utilization of water and fertilizers besides augmenting the productivity and quality.

Performance of Cabbage under 1.0 Epan and 80 % RDN & K

Performance

Scheduling of irrigation at 1.0 Epan with 420 mm of water gave higher head yield (24.15 t ha^{-1}) of *rabi* cabbage (Indu hybrid) over 0.8 Epan (21.92 t ha^{-1}). Fertigation of 80 % RDN & K (96:80 N:K_2O kg ha^{-1}) @1.28, 0.64 and 1.10 kg N ha^{-1} day^{-1} and 1.07, 0.53 and 0.91 kg K $ha^{-1}day^{-1}$ at 10-40 DAT, 41-60 DAT and 61-95 DAT, respectively in 21 splits once in four days from 10 DAS along with a common dose of 64 kg P_2O_5 ha^{-1} to soil as basal dose produced higher head yield (26.26 t ha^{-1}) over 60 % RDN & K (20.79 t ha^{-1}).

General view of Cabbage grown under Drip fertigation

Cost of Technology

The cost of technology (drip fertigation scheduled at 1.0 Epan and 80 % RDN & K) is ₹ 14,335/- (includes cost of fertilizer, irrigation and their application) excluding the cost of drip irrigation system.

Impact and Benefit

The technology of growing cabbage with drip fertigation scheduled at 1.0 Epan and 80 % RDN & K resulted in 14.28 and 26 % higher head yield over 0.8 Epan and 60 % RDN & K with B:C ratio of 2.3.

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Drip Fertigation for *kharif European Cucumber* under Different Coloured Shade nets

Salient Features

European cucumber is a variety of seedless cucumber that is longer and slim in size than other varieties of cucumber. In recent years, cultivation of vegetables under shade net increased as it minimizes the impact of biotic and abiotic stress. Coloured shade nets are intensively used primarily because of their ability to control the spectra of radiation so as to get different light induced effects on the plants, like increasing the fruit size and decreasing the duration of the production period. There is limited information on offseason cultivation of vegetables under protected cultivation in Telangana.

Performance

European cucumber grown under white coloured shade net (50 %, mono x mono) during *kharif* with 125% RDF (187.5:125:125 N:P_2O_5:K_20 kg ha^{-1}) gave higher fresh fruit yield (61.84 t ha^{-1}) followed by black and red colored shade nets with application of 100% recommended fertilizer (150-100-100 N:P_2O_5:K_20 kg ha^{-1}) (54.8 and 52.31 t ha^{-1}). The recommended fertiliser schedule is 1.11, 1.89, 3.05 and 0.69 kg N ha^{-1} day^{-1}, 3.75, 1.60, 2.08 and 0.33 kg P ha^{-1} day^{-1} and 1.25, 1.5, 1.67 and 1.0 K ha^{-1}day^{-1}for 125% RDF during 0-10 DAT (days after transplanting), 11-35, 36-50 and 51-100 DAT, respectively in 22 splits at three day interval.

European Cucumber under White Shade net

Cost of Technology

The cost of technology was ₹31,900/- for 125% RDF, (includes cost of fertilizer and their application) excluding cost of shade nets and drip systems.

European Cucumber under Black Shade net

Impact and Benefit

The highest B:C ratio (4.08) of cucumber was recorded under white coloured shade net with 125% RDF followed by black (3.71) and red coloured shade net (3.54) with 100% RDF.

European Cucumber under Red Shade net

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Drip Fertigation Levels for Cucumber under Naturally Ventilated Polyhouse

Salient Features

Salad cucumber cultivation under polyhouses in the recent times, is gaining popularity in Telangana. Drip irrigation including application of fertilizers with water provide optimal conditions for effective utilization of resources such as water and fertilizer. Improvement of crop yield by minimizing leaching losses of nutrients below the rooting zone could be achieved by managing fertilizer concentrations in measured quantities of irrigation water using drip irrigation.

Performance

Drip irrigation scheduled at 1.2 Epan with a total water usage of 286 mm produced significantly higher fruit yield of cucumber (83.2 t ha^{-1}), net returns (₹ 11,64,635 ha^{-1}) and BC ratio (3.24). Application of 150 % RDNK @ 225:150 N-K_2O kg ha^{-1} in 19 splits once in four days from 15 DAS to last picking (90:37.5 N-K_2O kg ha^{-1} during crop establishment to vegetative stage, 33.75:30 N-K_2O kg ha^{-1} during flower initiation to maturity stage and 101.25:82.5 N-K_2O kg ha^{-1} during harvesting stage (6 pickings) gave significantly higher fruit yield (76.6 t ha^{-1}), net returns (₹ 10,31,525 ha^{-1}) and B:C ratio (3.0).

Scheduling of irrigation at 1.0 Epan with 125 RDN & K

Cucumber crop cultivation in Polyhouse

Cost of Technology

Installation of drip system costs around ₹ 1,00,000 to 1,25,000 ha^{-1}. The construction cost of poly house for 500 m^2 slab area is approximately ₹2,50,000. The cost of technology excluding fixed cost is ₹28,200 ha^{-1} $year^{-1}$ (Including cost of fertilizer and irrigation water).

Impact and Benefit

In polyhouses, high value crops like cucumber can be cultivated round the year irrespective of season and climate. Cultivation of cucumber in polyhouse under drip irrigation at 1.2 Epan and 150 % RDKN fetched higher yield, good quality with B:C ratio of 3.24 and 3.0 respectively and helps to increase the income of the farmers.

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Eco-friendly Organic Weed Management in Baby Corn-Cabbage Cropping System

Salient Features

The consumer preference for organic food especially organic vegetables is increasing with increasing awareness about pesticide residues in food products. Weed management is considered as an important constraint in organic farming. Hence, development of effective and economical organic weed management strategy would help to maximize the yield and profit by keeping weeds under check. Baby corn- cabbage organic cropping system provides good profits to peri-urban farmers. Mulching with organics/poly film, live mulching, stale seed bed technique integrated with hand weeding were found to be effective in managing the weeds in organic baby corn-cabbage cropping system.

Performance

Baby corn grown with inter-row poly-film mulching (30 micron thickness) followed by (*fb*) intra-row hand weeding (HW) at 30 DAS produced higher yield (3071 kg ha^{-1}). The other treatments i.e., stale seed bed *fb* HW at 20 & 40 DAS (2796 kg ha^{-1}) and inter-row rice straw mulch @ 5 tons ha^{-1} *fb* intra row HW at 30 DAS (2779 kg ha^{-1}) resulted in higher baby corn yield during *kharif*. During *rabi* season, mulching with groundnut shells @ 2 t ha^{-1} resulted in higher cabbage yield (37160 kg ha^{-1}) followed by poly film mulch + intra row HW at 30 DAT (30075 kg ha^{-1}) and rice straw mulch @5 t ha^{-1}+ intra-row weeding at 30 DAT (28470 kg ha^{-1}) apart from effective weed suppression.

The system productivity in terms of baby corn equivalent yield was greater (16916 kg ha^{-1}) with live mulching with *dhaincha* upto 30 DAS in baby corn and groundnut shell mulching @ 2 t ha^{-1} in cabbage followed by poly mulch+ intra row HW at 30 DAS/T in both the crops (15101 kg ha^{-1}) or rice straw mulch @ 5 t ha^{-1}+ intra row HW at 30 DAS/T in both the crops (14167 kg ha^{-1}).

Groundnut shell mulching in cabbage

Cost of Technology

Poly film mulch + intra row HW: ₹ 37000 ha^{-1}

Rice straw (5 t ha^{-1}) mulch + intra row HW: ₹ 8750 ha^{-1}

Stale seed bed *fb* HW at 20 & 40 DAS : ₹12000 ha^{-1}

Dhaincha (*Sesbania*) live mulching : ₹3500 ha^{-1}

Groundnut shell mulching (2 tha^{-1}) : ₹3500 ha^{-1}

Impact and Benefit

Highest net returns and B:C ratio of the baby corn –cabbage organic cropping system were obtained with Dhaincha live mulching upto 30 DAS in baby corn and groundnut shell mulching @ 2 t ha^{-1} in cabbage (₹ 612500 and 3.57, respectively) followed by rice straw mulch @ 5 t ha^{-1}+intra row HW at 30 DAS/T in both the crops (₹ 465340 and 2.87, respectively) or poly mulch+ intra row HW at 30 DAS/T in both the crops (₹ 465950 and 2.58, respectively).

Poly film mulching in cabbage

Dhaincha live mulching in baby corn

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Integrated Weed Management Strategies for Higher Yields in Rainfed Pigeonpea

Salient Features

Weed management in rainfed crops is crucial for obtaining higher yield owing to unavailability of human labour, higher wages, narrow critical period of competition and heavy and continuous rainfall in *Kharif* season. Integration of different strategies (chemical and mechanical) to control broad spectrum of weeds at critical stages of pigeopea is essential to prevent yield losses due to weeds.

Performance

Pre-emergence application of pendimethalin 30 EC @ 0.75 kg a.i. ha^{-1} and post-emergence application (20-25 DAS) of Imazethapyr + Imazamox @ 100 g a.i. ha^{-1} followed by one inetrcultivation at 50 DAS controlled most of the broad leaved and grassy weeds, which in turn resulted in lower weed dry matter production and higher seed yield of pigeonpea (1558 kg ha^{-1}), net returns (₹ 62,113 ha^{-1}) and B:C ratio (2.95) as compared to unweeded control (₹ 26,931 ha^{-1} and 2.05, respectively) during *kharif* season.

Performance of the Pigeonpea in best weed control treatment


Weedy check treatment

Cost of Technology

The cost of Pre-emergence application of pendimethalin 30 EC @ 0.75 kg a.i. ha^{-1} and post-emergence application (20-25 DAS) of Imazethapyr + Imazamox @ 100 g a.i. ha^{-1} was around ₹3250 ha^{-1} (Cost saving of ₹2935 ha^{-1} as compared to farmer's practice where two hand weedings at 20 and 40 DAS were followed).

Impact and Benefit

Pre-emergence application of pendimethalin 30 EC @ 0.75 kg a.i. ha^{-1} followed by post-emergence application (20-25 DAS) of Imazethapyr + Imazamox @ 100 g a.i. ha^{-1} fb intercultivation at 50 DAS was found efficient in controlling weeds, saving time & labour, higher yield and income besides reducing cost of cultivation of pigeonpea.

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Agro-Ecological Options for Fall Army Worm (FAW) Management in Maize

Salient Features

Maize is a preferred host of fall army worm (*Spodoptera frugiperda*), an invasive pest which is highly migratory and economically destructive and its sudden outbreak is threatening maize production across the country. Legume based intercropping in maize is one of the Agro-ecological approaches that can be readily integrated into existing system to control FAW incidence, improve small holders income and increase resilience through sustainable intensification. Push-Pull strategy is another habitat management option developed and implemented to manage FAW. The technology entails using a repellent intercrops as "push" and attractive trap crop as "pull". The incidence and control of FAW in Maize was tested with two row arrangements (1:1 and 2:2) with four legume intercrops *viz.*, Soybean, Groundnut, Greengram and cowpea during *Kharif* season and Marigold, Coriander, Mint and Desmodium during *Rabi* season.

Performance

Maize based legume intercropping systems *viz.,* Maize + Greengram and Maize + Groundnut realized higher Maize Equivalent yield (11.076 t ha^{-1}) compared to maize - Soybean and maize - cowpea during *kharif* season. The FAW infestation on maize was less with Maize + Cowpea (26.8% & 35.6%) followed by Maize + Greengram (33.8% & 47.2%) systems compared to sole maize in 1:1 and 2:2 row arrangement respectively. In terms of economics, Maize+ Greengram system gave higher net returns (₹ 1,69,498) and B:C ratio (2.89) due to high prevailing market price for greengram. In Push-Pull strategy, among the repellent intercrops during *rabi* season, Maize + Coriander and Maize + Marigold realized higher Maize equivalent yield (11.06 & 10.954 t ha^{-1}) compared to Mint and Desmodium. The FAW infestation on maize was less with Maize + Coriander (17 % & 23.7 %) followed by Maize + Desmodium (17.3 % & 21.5 %) inter cropping systems compared to sole maize in 1:1 and 2:2 row arrangements respectively.

Maize + Greengram (1:1) cropping system during *kharif* season

Cost of Technology

The cost of technology involving legume crops as intercrops in maize was around ₹ 47300 ha^{-1} as the legumes were grown in additive series. An amount of ₹ 7500 ha^{-1} on chemicals was saved.

Maize + Coriander (2:2) cropping system during *Rabi* season

Impact and Benefit

In this technology, intercropping of maize with greengram during *kharif* and coriander during *rabi* season was found as a low cost agro-ecological approach and can be promoted as a core component of integrated pest management (IPM) in reducing the incidence of FAW in maize.

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Diversified and Remunerative Cropping Systems for Designing Crop Plan in Integrated Farming Systems

Salient Features

Rice, cotton and maize are the predominant crops grown either as monoculture or rarely in rotation with other crops in Telangana state. Several problems are cropping up in the state as these crops are highly exhaustive and non–leguminous. Hence, there is a need to identify new diversified systems considering economic, ecological and social dimensions for overall development of the state, particularly farming community. To meet diverse needs of farm family in IFS perspective, the cropping systems involving pulses, oilseeds, cereals and fodder crops are evaluated for their long term sustainability and inclusion in the crop module of IFS for efficient utilization as well as recycling of resources within the system.

View of cropping systems during *Rabi* Season

Performance

Sweet corn – tomato cropping system gave higher system productivity (25.09 t ha^{-1}), net returns (₹ 3,44,110 ha^{-1}) and BC ratio (3.42) under income enhancement approach. Pigeonpea + maize (1:3) – groundnut (14.27 t ha^{-1}, ₹ 163700 and 1.73) stood better in meeting cereal, pulse and oilseed household nutritional requirement. For improving soil health and ecological sustainability, the cropping system *Bt* cotton + greengram (1:3) - groundnut system was found efficient (14.13 t ha^{-1}, ₹ 161880 and 1.68). Similarly to meet fodder requirement of livestock, fodder maize – lucerne gave higher system productivity (7.81 t ha^{-1}) including *per se* cereal fodder production of 37.8 t ha^{-1} and legume fodder of 32.0 t ha^{-1}. All the above systems gave higher system productivity, net returns and B:C ratio over that of pre-dominant cropping systems *viz.*, rice – maize and *Bt* cotton - fallow except fodder based cropping systems.

View of cropping systems during *Kharif* Season

Cost of Technology

The cost of cultivation (ha^{-1}) of the technology involving different cropping systems varied from ₹ 53,210 (Fodder maize – Lucerne) to ₹ 1,00,640 (Sweetcorn – Tomato) compared to that of predominant systems *viz.*, Rice – Maize (₹83,270) and Bt cotton – Fallow (₹46,675). The cost of cultivation of other identified systems *viz.*, *Bt* cotton + Greengram (1:3) – Groundnut was ₹96,130/- and for Pigeonpea + Maize (1:3) – Groundnut, it was ₹ 94,595.

Impact and Benefit

The sweet corn – tomato system for higher income, *Bt* cotton + greengram (1:3) – groundnut to instill ecological sustainability, pigeonpea + maize (1:3) - groundnut system to meet household nutritional security and fodder maize – lucerne system for meeting fodder needs of livestock were found profitable compared to predominant systems being followed in Telangana state. These systems can find a place in crop module of integrated farming systems for efficient utilization of resources.

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Soil Test Based Fertilizer Prescription Equations for Targeted Yield of Sesamum in Light Soils

Salient Features

In the era of precision agriculture, the concept of soil test-based fertilizer recommendation harmonizes the much-debated approaches namely, fertilizing the soil versus fertilizing the crop ensuring for real balance (not apparent balance) between the applied fertilizer nutrients among them-selves and with the soil available nutrients. STCR equation developed for sesamum crop in light soils of Northern Telangana Zone and its adoptability in farmer's fields enhances income and saves costly inputs (fertilizers).

Performance

Soil test based prescription equation for targeted seed yield of sesamum crop was developed in light soils of NTZ for two situations *viz.*, with chemical fertilizers alone and IPNS. The fertilizer prescription equations for a target seed yield of 8 q ha^{-1} is given below.

Only with chemical fertilizers	With Chemical fertilizers + Vermicompost @ 5 t ha^{-1}
FN= 21.14 T – 0.40 SN (for nitrogen)	FN= 21.14 T – 0.40 STVN – 0.58 VCN (for nitrogen)
FP= 4.92 T – 0.50 SP (for phosphorus)	FP= 4.92 T – 0.50 STVP – 0.18 VCP (for phosphorus)
FK= 4.89 T- 0.04 SK (for potassium)	FK= 4.89 T- 0.04 STVK – 0.18 VCK (for potassium)

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

When soil test values were 101 kg N, 28 kg P and 200 kg K ha^{-1}, by using above equation, the application of 129 kg nitrogen, 25 kg P_2O_5 and 31 kg K_2O ha^{-1} was estimated as needed to attain target yield of 8 q ha^{-1} with chemical fertilizers alone, whereas 94 kg nitrogen, 20 kg phosphorus and 17 kg potassium were needed along with 5 t ha vermi-compost to attain the target yield in sesamum. The deviation in fertilizer use by employing soil test based prescription equations in comparison with that of general RDF (80:20:20 kg NPK ha^{-1}) was (+) 14 kg N, 0 kg Phosphorus and (-) 3 kg Potassium in light soils. These fertilizer prescription targeted yield equations can be recommended to light soils of Northern Telangana Zone to attain the target yield of 8 q ha^{-1} in sesamum with a lesser nutrient application rate compared to RDF.

Over view of the experiment

Cost of Technology

The cost of soil testing in the government soil testing laboratories range from ₹10 to 20 (Farmer's field) per sample. This technology can be implemented with soil testing and interpretation of results.

Performance of the sesamum in 1X treatment

Impact and Benefit

This envisages a balanced nutrient supply to sesamum which is site specific and can play a major role in precision agriculture. The specific yield equation based on soil health will not only ensure sustainable crop production and also pave the way for economic use of costly fertilizer inputs.

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Nutrient Management in Sweet corn-Red gram Sequence in Mango based Agri-horti System in Marginal Lands

Salient Features

Mango is a major fruit crop in Telangana, cultivated in an area of 1.16 lakh hectares with a production of 10.23 lakh tones. Inter cropping with cereals, legumes and vegetables in mango during early years of establishment helps in spatial and temporal complementarity and achieving additional income. Application of 125 % RDF to sweet corn (*kharif*) - redgram (*rabi*) intercropping in Mango based agri-horti system was found profitable on marginal lands of Telangana state.

Performance

In Mango based agri - horti system, at early stage of establishment in mango upto 4-5 years, intercropping with *kharif* sweet corn and *rabi* redgram with application of 125 % RDF gave significantly higher maize equivalent yield (13.46 t ha^{-1}), total system net returns (₹ 1,54,888) and B:C ratio (2.18) over organic manure applied treatment, but onpar with 100% RDF and 75% RDN through inorganic + 25 % RDN through Poultry manure / Farm yard manure.

Performance of Sweet corn in mango - based agri-horti system during *kharif* season

Performance of Redgram in mango - based agri-horti system during *rabi* season

Cost of Technology

The cost of technology (125 % N) was ₹ 2,650 ha^{-1} and was Rs 6,000 ha^{-1} for 75% N through inorganic fertilizer and 25% N through organic manure. The cost saved over integrated nutrient management was ₹ 3,350 ha^{-1}.

Impact and Benefit

In mango orchards, curry leaf as filler crop in between mango will give regular income to the farmer. In Mango based agri - horti system, at early stage of establishment up to 4-5 years, application of 125 % RDF to sweet corn (*kharif*) - redgram (*rabi*) can be recommended to farmers for getting higher yield and net returns

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Design and Development of Low Cost Microcontroller based Precision Planter for Maize and Cotton

Salient Features

The microcontroller based precision planter was designed and developed in order to maintain uniform seed to seed spacing in maize and cotton crops. It consists of microcontroller, geared DC motor, seed metering unit, chain and sprocket for power transmission. Tractor battery is used as an input source of power for the planter and from the battery the voltage is reduced from 12 v to 5 v by step down converter. The wheel rpm sensor senses the rotational rpm of front wheel and sends the signal to microcontroller. The microcontroller upon getting the signal from ground wheel, actuates relay driver through PWM motor speed controller. After receiving PWM signal, signal strength is selected at potentiometer. Potentiometer is attached to the motor controller and it used to maintain or achieve the desired geared DC motor rpm. The power of geared DC motor is transferred to seed metering shaft through chain drive. The recommend spacing as per PJTSAU package of practice for maize crop is 60 cm x 20 cm and seed rate is 20 kg ha^{-1}. For cotton crop the spacing is 120 cm x 60 cm and seed rate is 2.5 kg ha^{-1}.

Performance

The average missing index, multiple index and quality feed index of microcontroller operated planter is 6.6 %, 10 %, and 83.4 % respectively compared to that of ground wheel operated planter(20.3 %, 23.3 %, and 56.4 %, respectively). The field efficiency and effective field capacity of microcontroller operated planter is 0.35 ha h^{-1} and 77.7% as compared to ground wheel operated planter (0.31 ha h^{-1} and 68.8%). The fuel consumption of microcontroller operated planter is 3.5 l h^{-1} whereas ground wheel driven planter is 3.8 l h^{-1}. The average seed spacing of micro-controller operated planter is 214 mm and that of ground driven planter is 246 mm.

Sowing of maize with microcontroller based precision planter

Sowing of cotton with microcontroller based precision planter

Cost of Technology

The cost of the technology was ₹ 35,000. The cost of sowing operation with microcontroller operated planter was ₹ 1,920 ha^{-1} and was ₹ 2360 ha^{-1} with ground driven planter for cotton and maize crop, respectively.

Impact and Benefit

There is a net saving of ₹ 440 ha^{-1} for sowing operation of maize and cotton with the developed microcontroller planter over ground wheel driven planter.

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Effective Management of Gall Midge in Rice with Insecticides

Salient Features

Gall midge occurs in many of the rice growing areas and causes considerable yield loss even up to 70 % in *kharif* crop. Many resistant varieties are being cultivated but the occurrence of biotypic variation of the insect limits their extensive use. Timely application of suitable insecticide in proper dose for the control of gall midge is important and gives better results.

Performance

Application of carbofuran 3G @ 25 kg ha^{-1} (nursery + main field) recorded the lowest silver shoot incidence (7.96 %) in rice followed by fipronil 0.3 G @ 20 kg ha^{-1} (nursery+ main field) (9.90%), thiamethoxam 25WG @ 0.25g L^{-1} (nursery) + fipronil 0.3 G (main field) (10.32%), fipronil 0.3 G (nursery) + fipronil 5 SC @2ml L^{-1} (main field) (10.45%), fipronil 5% SC (nursery + main field) (10.83%) and thiamethoxam 25 WG (nursery) + fipronil 5% SC (main field) (10.91%) at 60 DAT and all the latter treatments were on par. Carbofuran 3G @ 25 kg ha^{-1} (nursery + main field) resulted in a net profit of ₹ 23,916 and a benefit:cost ratio of 3.73 followed by thiamethoxam 25WG @ 0.25 g L^{-1} (nursery) + fipronil 0.3 G (main field) (₹ 17,869 and 3.29) and fipronil 0.3 G (nursery+ main field) (₹ 20,356 and 3.22).

Effective management of gall midge in rice with insecticides

Field view of the experiment

Cost of Technology

Cost of treatments was ₹6416 ha^{-1} for carbofuran 3G @ 25 kg ha^{-1} (nursery + main field) and ₹5425 ha^{-1} for thiamethoxam 25 WG @ 0.25 g L^{-1} (nursery)+fipronil 0.3G (Main field).

Impact and Benefit

Application of carbofuran 3G @25 kg acre^{-1} (nursery + main field) was found to be efficient in controlling the incidence of gall midge with highest productivity and profitability (B:C ratio, 3.73) of rice crop.

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Suitable Combinations of Pesticides for Seed Treatment against Pests and Diseases in Soybean

Salient Features

A powerful tool that can deliver early seedling emergence, better plant stand with vigorous plants is the need of the hour for higher yield and quality. Innovative seed treatment products protect the seedlings against destructive early-season pests and also give good returns at the end of the season. Effective combination of fungicides and insecticides through seed treatment can be a boost for pest and disease control by reducing the cost of repeated applications.

Performance

Soybean seeds treated with Thiamethoxam @ 4g kg^{-1} seed + fungicide (Carboxin + Thiram) @ 2g kg^{-1} seed recorded lower incidence of root rot disease and lesser infestation of stem fly, stem girdler, leaf hopper and whitefly. This helped in realising higher yield (1618 kg ha^{-1}), net returns (₹10507 ha^{-1}) and B:C ratio (1.19) as compared to no seed treatment (1200 kg ha^{-1}, ₹4750 ha^{-1} and 0.91).

Field view of the experiment

Field view of treated and untreated treatments

Cost of Technology

The cost of seed treatment chemicals was ₹1750 ha^{-1}. Additional costs incurred for repeated foliar sprays of insecticide and fungicide separately may be saved.

Impact and Benefit

Seed treatment with combination of insecticide Thiamethoxam @ 4 g kg^{-1} seed and fungicide (Carboxin + Thiram @2g kg^{-1} seed) helps the soybean farmers in Northern Telangana Zone in minimizing plant protection costs and effectively managing both insect pests and diseases with less input cost.

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Pre-harvest spraying of Botanicals for the Management of Pulse Beetle (*Callosobruchus* sp.) in Pigeonpea

Salient Features:

Pulse beetle, *Callosobruchus spp*. belonging to the family Chrysomelidae, order Coleoptera is the most destructive field carry over pest of stored pulses especially whole seeds. Pre-harvest sanitation spray is a novel method to arrest these insects in the field itself, thereby limiting the damage during storage. It involves spraying of botanicals or insecticides during the pod formation and development stages at suitable intervals.

Comparing seed quality of redgram in Azadirachtin sprayed plot (left) with untreated control (right).

Performance

Spraying of Emamectin benzoate @ 0.3 g L^{-1} and Azadirachtin T/S 10,000 ppm @ 6 ml L^{-1} at 50% pod maturity and at maturity of pigeonpea recorded significantly lowest number of adults (12.00 and 10.44, respectively) and they were on par with each other. The seed yield (11.20 q ha^{-1}), net returns (₹15,600 ha^{-1}) and B:C ratio was higher in Azadirachtin (1.12) compared to Emamectin Benzoate (11.0 q ha^{-1}, ₹13000 ha^{-1} and 1.10, respectively).

Spraying of botanicals at 50 % pod maturity and at maturity of pigeonpea was found to be significantly superior in reducing the adult emergence than spraying only at 50% pod maturity or spraying only at maturity.

Field view of the experiment

Cost of Technology

Cost of two sprays of Azadirachtin T/S 10000 ppm @ 6 ml L^{-1} at 50% pod maturity and at maturity is ₹ 4050 ha^{-1}. Cost of two sprays of Emamectin benzoate @ 0.3g L^{-1} at 50% pod maturity and at maturity was ₹ 540 ha^{-1}.

Impact and Benefit

Marginal and sub-marginal farmers are unable to spray/fumigate their godowns as most of them store their produce in gunny bags or in houses. Controlling pulse beetle incidence in the field itself will prevent the pest from entering into godowns and its further spread to uninfected seeds. Hence, two pre-harvest sprays, one at 50% pod maturity and another at maturity with Azadirachtin T/S 10,000 ppm @ 6 ml L^{-1} or Emamectin benzoate @ 0.3g L^{-1} is an important step in quality seed production of pulses.

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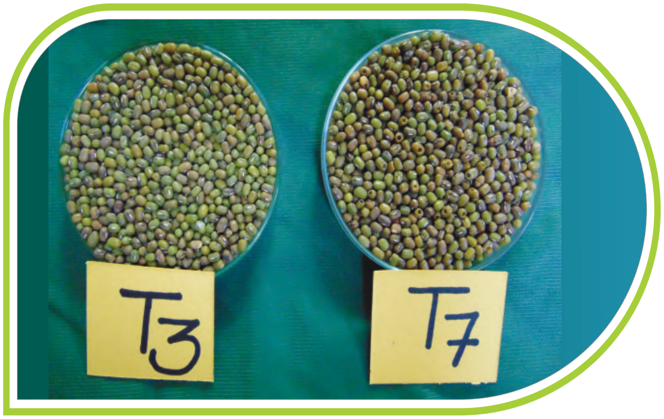
Solarization and Packaging Technlolgy for Bruchids Management in Greengram

Salient Features:

The pulse beetle or Bruchid, *Callosobruchus chinensis* is an important storage pest of green gram which infests during both pre and post-harvest stages. The ovipositional potential, adult emergence, seed damage caused by the beetle decreases above 35ºC temperature. To maintain seed quality during storage, it is better to store them in moisture vapour-proof containers like polythene bags with 700 gauge. Solarization cum packaging in clear polyethylene (700 gauge) packets is a novel approach for extending the storability of seeds and also helps in beetle management.

Performance

Solarization of fresh seeds in clear polyethylene (700 gauge) packet for 4 h day^{-1} for 6 days was able to maintain seed damage below permissible limit (0.43%) and germination (93.6%) of Indian Minimum Seed Certification Standards upto nine months of storage compared with that of untreated control with seed damage of 3.39 % and 90.70% germination. Clear polyethylene (700 gauge) packet served as a moisture vapour-proof container and reduced moisture by 4.7% over the untreated control.



Solarization of fresh seeds in clear polyethylene (700 gauge) packet for 4 h day^{-1} for 6 days (left) compared with untreated control (right)

Cost of Technology

While, solarization utilizes free solar energy, the cost of clear polyethylene (700 gauge) packet was ₹2000 for one ton of seed.

Effect of solarization on greengram germination after 9 months of storage

Impact and Benefit

Solar disinfestation is a cost effective, nontoxic technology for beetle management in greengram. As the seed is hygroscopic in nature, seed quality is affected by fluctuations in moisture content, relative humidity and temperature. Packaging material made with 700 gauge polyethylene serves as a moisture vapour-proof container, creating hermatic conditions killing the insect due to hyper carbic and hypoxic conditions while retaining the natural properties and viability of seed.

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Pre and Post Harvest Seed Treatment and Fungicidal Sprays to Enhance Seed Health and Storability in Soybean

Salient Features

Soybean is the most important oil seed crop and known for its enriching protein (42-45%) and oil content (22%). In Telangana state, the crop is cultivated in an area of 1.62 lakh ha with production and productivity of 2.45 lakh tons and 1503 kg ha^{-1}, respectively. Seed borne diseases are known to impact the health and quality of seeds during storage, which eventually reduce germination and seedling vigour. Hence, a suitable and cost effective management approach is essential to mitigate the losses caused by seed borne pathogens.

Performance

Seed treatment of soybean cv.JS 335 with carboxin+ thiram @ 3 g kg^{-1} before sowing followed by sprays of three combination fungicides evaluated against foliar and pod diseases and found that three sprays of pyraclostrobin + metiram @2 g L^{-1} at pod development, seed development and seed maturity stages recorded lesser incidence of anthracnose (0.82%) and cercopsora leaf spot (0.30%) disease with increased seed yield (2,160 kg ha^{-1}) and B:C ratio (3.38) and additional returns of ₹16,079 over control (1,320 kg ha^{-1} with B.C ratio 2.06). Seeds were subjected to storage after treating with carboxin+thiram @3 g kg^{-1} ensured storability upto 12 months and germination of 73% over untreated seeds with 8 months storability and 70% germination.


Germination of untreated seeds at 10 months after storage


Germination of Carboxin + thiram treated seeds at 10 months after storage

Cost of Technology

Cost of preseed treatment in soybean was ₹ 375 ha^{-1} and cost of three sprayings of fungicide pyraclostrobin + metiram for three sprays was ₹7,871/-. Cost of post harvest seed treatment was ₹375 ha^{-1} The total cost of technology was ₹ 8,621/-.

Impact and Benefit

Adoption of pre and post harvest seed treatment of soybean with carboxin+thiram @3 g kg^{-1} in soybean along with three foliar application of pyraclostrobin + metiram @ 0.2% at pod development, seed development and seed maturity stages enhances seed yield and storability with lesser incidence of anthracnose and cercopsora leaf spot diseases and achieved B:C ratio of 3.38.


Three sprays of Pyraclostrobin + Metiram @2 g L^{-1}


Untreated control

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ANNEXURE

Agro Technologies 2021-22 - Contributors

Sl. No.	Name of the Agro Technology	Research Station and Scientists Contributed
1	Machine Transplanting is the Profitable Way of Rice Establishment	**Institute of Rice Research, ARI, R'nagar** Dr. P. Spandana Bhatt, Dr. M. Venkata Ramana Dr. P. Raghu Rami Reddy
2	Optimum Date of Sowing and Drip Fertigation for Higher Yield in Rabi Mustard	**Water Technology Centre, R'nagar** Dr. Md. Latheef Pasha, Dr. T. L. Neelima, Dr. K. Avil Kumar, Mr. K. Chaitanya, Dr. M. Uma Devi **RARS, Jagtial** Dr. P. Madhukar Rao, Dr. T. L. Neelima, Dr. N. Mahesh, Mis. N. Navatha, Dr. E. Rajanikanth
3	Optimum Seed Rate and Spacing for Higher Fodder Production of Hedge Lucerne	**AICRP on Forage crops, R'nagar.** Dr. RVT. Balazzii Naaiik, Dr. T. Sukruth Kumar, Mr. B. Murali, Dr. K. Sailaja, Dr. T. Shashikala
4	Bio Fortification with Zinc and Iron for Improving the Quality of Annual Cereal (Maize and Sorghum) Fodder Crops	**AICRP on Forage crops, R'nagar.** Dr. RVT. Balazzii Naaiik, Dr. Sukruth Kumar, Mr. B. Murali, Dr. K. Sailaja, Dr. T. Shashikala
5	Integrated Use of Bio Fertilizers, Organic Manures & Inorgonic Fertilizers on Growth and Yield of Winter Maize	**ARS, Karimnagar** Dr. G. Manjulatha, Dr. E. Rajanikanth, Dr. A. Krishna Chaitanya, Dr. S. Triveni
6	Management of Maize Crop Residue and Optimization of Fertilizer Levels on Succeeding Rabi Crops	**ARS, Karimnagar** Dr. G. Manjulatha, Dr. E. Rajanikanth, Dr. P. Ravi, Dr. B. Sowjanya, Dr. S. Triveni
7	Drip Irrigation Schedule for Coloured Capsicum Varieties under Green Shade Net	**Water Technology Centre, Rajendranagar** Mr. K. Chaitanya, Dr. A. Manohar Rao, Dr. M.Uma Devi, Dr. K. Avil Kumar, Dr. T. L. Neelima, Dr. Md. Latheef Pasha
8	Drip irrigation and Fertigation Schedule for *Rabi* Brinjal	**Water Technology Centre, R'nagar** Dr. K. Avil Kumar, Dr. T. L. Neelima, Mr. K. Chaitanya, Dr. M. Uma Devi
9	Drip Irrigation Regimes and Fertigation Schedule for *Rabi* Capsicum under Different Coloured Shade nets	**Water Technology Centre, R'nagar.** Dr. M. Uma Devi, Mr. K. Chaitanya & Dr. K. Avil Kumar
10	Drip Fertigation Schedule in *Rabi* Cabbage	**Water Technology Centre, Rajendranagar** Mr. K. Chaitanya, Dr. M. Uma Devi, Dr. T. L. Neelima, Dr. K. Avil Kumar, Dr. Md. Latheef Pasha
11	Drip Fertigation for kharif European Cucumber Under Different Coloured Shade nets	**Water Technology Centre, Rajendranagar** Dr. M. Uma Devi, Mr. K. Chaitanya & Dr. K.Avil Kumar
12	Drip Fertigation Levels for Cucumber under Naturally Ventilated Polyhouse	**Water Technology Centre, R'nagar** Dr. Md. Latheef Pasha, Dr. K. Avil Kumar, Dr. M. Uma Devi, Mr. K. Chaitanya, Dr. T. L. Neelima
13	Eco-friendly Organic Weed Management in Baby Corn-Cabbage Cropping System	**AICRP on Weed Management, R'nagar** Dr. B. Padmaja, Dr. T. Ram Prakash, Dr. M. Madhavi

Agro Technologies 2021-22 - Contributors

Sl. No.	Name of the Agro Technology	Research Station and Scientists Contributed
14	Integrated Weed Management Strategies for Higher Yields in Rainfed Pigeonpea	**RARS, Warangal** Dr. M. Madhu, Mrs. Ch. Pallavi
15	Agro-Ecological Options for Fall Army Worm (FAW) Management in Maize	**MRC, ARI, R'nagar** Dr. D.Sreelatha, Dr. Y. Sivalakshmi, Dr. M. V. Nagesh Kumar, Dr. B. Mallaiah, Dr. J. C. Sekhar, Dr. P. Lakshmi Sowjanya
16	Diversified and Remunerative Cropping Systems for Designing Crop Plan in Integrated Farming Systems	**AICRP on IFS, Rajendranagar** Dr. Ch. Pragathi Kumari, Dr. M. Venkata Ramana, Dr. M. Goverdhan, Dr. G. Kiran Reddy, Dr. S. Sridevi, Dr. K. Chiranjeevi
17	Soil Test Based Fertilizer Prescription Equations for Targeted Yield of Sesamum in Light Soils	**RARS, Jagtial** Dr. A. Krishna Chaitanya, Dr. A. Madhavi, Dr.T.Srijaya, Dr.P.Ravi, Dr.B.Raju
18	Nutritient Management in Sweet corn - Red gram Sequence in Mango based Agri-Horti system in Marginal Lands	**AICRP on Agroforestry, R'nagar** Dr. T. Chaitanya, Dr. A. Krishna
19	Design and Development of Low Cost Microcontroller based Precision Planter for Maize and Cotton	**AICRP on FIM Scheme, Rajendranagar** Dr. Ch. Sravan Kumar, Dr. B. Rajaiah, Dr. B. Laxman, Dr. B. Vennela
20	Effective Management of Gall Midge in Rice with Insecticides	**RARS, Jagtial** Dr. S. Omprakash
21	Suitable Combinations of Pesticides for Seed Treatment against Pest and Diseases in Soybean	**ARS, Adilabad** Dr. K. Rajashekar
22	Pre-Harvest Spraying of Botanicals for the Management of Pulse Beetle (*Callosobruchus* sp.) in Pigeonpea	**SRTC, R'nagar** Dr. A. Padmasri, Dr. M. V. Nagesh Kumar, Dr. P. Jagan Mohan Rao
23	Solarization and Packaging Technology for Bruchids Management in Greengram	**SRTC, R'nagar** Dr. A. Padmasri, Dr. B. Pushpavathi, Dr. M. Madhavi, Dr. M.Rajender Reddy, Dr. V. Bharathi, Dr. P. Jagan Mohan Rao, Dr. M. V. Nagesh Kumar
24	Pre and Post Harvest Seed Treatment and Fungicidal Sprays to Enhance Seed Health and Storability in Soybean	**SRTC, R'nagar** Dr. A. Padmasri, Dr. M. V. Nagesh Kumar, Dr. P. Jagan Mohan Rao

Publ. No. 31 / BL / PJTSAU / 2023

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