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Biological control in rice cultivation of Araku valley, Visakhapatnam district, Andhra Pradesh: A boost to organic farming by tribal farmers

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Abstract

The objective of the programme is to increase the net incomes of small and marginal as well as women tribal farmers with the popularization of biological control in rice cultivation through frontline demonstrations, training programmes, exposure visits, fields days and rythusadassu. The Tribal farmers are exposed to ecofriendly low cost biological control techniques in rice cultivation which AICRP Biological control believes is a stepping stone for sustainable agriculture. During first year, 2015-16, Field release of *Trichogramma japonicum* and *Trichogramma chilonis* effectively reduced the stem borer damage (89.4%) and leaf folder damage (88.2%) resulted in higher yields (4025 kg/ ha) with biological control practices compared to 2100 kg / ha compared to traditional rice cultivation. Additional yield recorded by organic rice farmers was 1925kg/ha with additional income of Rs.19,250/- and incremental benefit cost ratio of 1: 4.4 compared to farmers practice of no fertilizer and no plant protection. during 2016-17, biological control in rice reduced the stem borer (87.2%), leaf folder damage (89.4%) and recorded higher yields (4500 kg/ ha) with incremental benefit cost ratio of 1:5.63 compared to traditional rice cultivation (2300 kg/ha). Similarly, adoption of biological control gave higher rice yields (4625 kg/ ha) with incremental benefit cost ratio of 1:5.4 compared to farmers practice (2450 kg/ha) in 2019-20. Tribal farmers realized the use of Biological control in preventing pests and diseases in rice cultivation and expressed willingness to adopt the technology for achieving higher yields.

Keywords: Biocontrol agents, Biopesticides, *Pseudomonas fluorescence*, Rice, *Trichogramma chilonis*, *Trichogramma japonicum*

Introduction

Rice is a major crop in tribal areas of north coastal zone of Andhra Pradesh. Tribal farmers cultivate rice under natural conditions with local rice varieties without adopting nutrient and pest management practices which resulted in very low yields. Organic cultivation in rice is very much a feasible proposition in tribal areas of Andhra Pradesh state where chemical use is absolutely nil. Arakuvalley tribal farmers with small land holdings of half an acre to one acre are benefited from ICAR- Tribal Sub Plan programme implemented by All india coordinated research project on Biological Control working at Regional Agricultural Research Station, Anakapallen under Acharya N.G.Ranga Agricultural University, Andhra Pradesh from the year 2015-16 to 2019-20.

Materials and Methods

Rice organic farming techniques were adopted in pest management using bocontrol agents, biopesticides and nutrient management using biofertilizers by tribal farmers through Fronline large scale demonstrations, farmers training programmes, method demonstrations. Exposure visits, Field days and Rythusadassus's were organiswed for the promotion of the technology in adjacent tribal villages. Biocontrol agents, *Trichogramma chilonis* @ 1,00,000 egg parasitoids / ha /release against rice leaf folder and *Trichogramma japonicum* @ 1,00,000 egg parasitoids / ha /release against rice stem borer as Trichocards, 3 times each at weekly interval from 25 days after transplanting was demonstrated. Biopesticides, *Pseudomonas fluorescence* as seed treatment @ 10 g/kg seed and as foliar spray @ 5 g/lt for management of rice blast and sheath blight was conducted. Educated the farmers on Liquid biofertilizers, *Azospirillum* and *Phosphobacteria* each @ 500 ml/ acre mixed with 25 kg FYM and broadcasted at the time of transplanting.

Results and Discussion

During first year, 2015-16, Front line demonstrations, training programmes, method demonstrations, field days on rice Organic farming techniques was conducted in 40 acres area at two villages i.e., Kothavalasa and Gunjariguda, Dumbbriguda mandal, Araku valley, Visakhapatnam district, Andhra Pradesh benefiting 50 farmers. Six releases of egg parasitoids, effective management of blast and sheath blight diseases. Field release of *Trichogramma japonicum* and *Trichogramma chilonis* effectively reduced the stem borer damage (89.4%) and leaf folder damage (88.2%) compared to traditional rice cultivation during 2015-16. Tribal farmers recorded higher yields (4025 kg/ha) with biological control practices compared to 2100 kg / ha in farmers practice. Additional yield recorded by organic rice farmers was 1925kg/ha with additional income of Rs. 19,250/- and incremental benefit cost ratio of 1:4.4 compared to farmers practice of no fertilizer and no plant protection.

During 2016-17, improved rice varieties, MTU 1075, RNR 15048 were introduced along with biopesticides, Biofertilizers and Biocontrol agents for 45 farmers covering 43 acres. Percent reduction in stem borer (87.2%) and leaf folder damage (89.4%) was high in biological control resulted in higher yields (4500 kg/ ha) with incremental benefit cost ratio of 1:5.63 compared to farmers practice of no fertilizer and no plant protection (2300 kg / ha). Potential successes of advanced biocontrol based IOM systems was realized in rice in farmer field (Dirk Babendreie *et al.*, 2020)^[1]. Adoption of biological control practices recorded higher rice yields (4625 kg/ ha) with incremental benefit cost ratio of 1:5.4 compared to traditional cultivation with no fertilizer and no plant protection (2450 kg / ha) in 2019-20.

Biopesticide, *Pseudomonas fluorescence* as seed treatment and as foliar spray resulted in effective management of blast and sheath blight diseases in rice. Field release of *Trichogramma japonicum* reduced rice stem borer damage and *Trichogramma chilonis* gave protection against rice leaf folder.

Training imparted to 40 tribal of Asarada, GK veedhi mandal, Chinthapalli farmers on *Trichogramma chilonis* production using Eri silkworm eggs and *Corcyra* eggs at AICRP on Biological control, Anakapalle. Trichocard production unit constructed under ICAR Tribal sub plan programme was handed over to Trichocard rythumitra group (15 Tribal farmers) of Asarada village and motivated tribal youth for production of trichocards from kharif, 2018. Transferred

Biological control techniques through rice organic farming covering 165 acres of rice in Chinthapalli and Arakuvalley divisions of Visakhapatnam district, Andhra Pradesh through front line demonstrations, farmers trainings, method demonstrations, exposure visits, rythusadassus's, Exposure visit and created awareness on biocontrol agents, biopesticides and biofertilizers. Around 280 Tribal Farmers of 11 villages are benefited from ICAR- Tribal Sub Plan Programme implemented by AICRP on Biological Control Scheme, ANGRAU for improving the livelihood of tribal farmers through organic farming cultivation in rice. Farmers perception on importance of biological control in rice was collected from FLD farmers. Majority of farmers expressed biological control as effective method providing satisfactory control of rice pests and diseases in tribal areas. Tribal farmers realized the use of biofertilizers application with good tillering and more productive tillers (8-10 tillers/hill) without zinc deficiency symptoms in organic farming block compared to check plot with poor tillering severe zinc deficiency in organic farming compared to traditional practice without using any fertilizers (4 tillers/hill) and observed nil incidence of stem borer as deadhearts and white ears and also leaf folder damage and severe incidence of stemborer as deadhearts and white ears and leaf folder damage.

The feed back from Killo Bhimala, tribal women farmer from Kothavalasa expressed that use of yellow cards (Trichocards) in paddy 4 times by clipping to paddy leaves prevented deadhearts and white ears by stem borer and leaf damage by leaf folder and happy to use trichocards for pest control as it is easy technique compared to severe incidence of deadhearts and white ears and leaf folding symptoms in traditional rice cultivation. Pangi Narasayya, tribal farmer from Kothavalasa said that paddy cultivation became profitable. B. Krishna, tribal farmer from Gunjariguda expressed happiness in showing the healthy paddy crop with the application of biofertilizers and interested to adopt the technology in his total cropped area for achieving higher yields. The tricho cards, they say, do not have any biological side-effects, and the use of artificial pesticides being avoided, the paddy thus produced can be labelled as organic.

This study indicate that rice production systems in tribal areas offer great scope to reduce pesticide use inturn improve human and environmental health. Similarly, case study reported biological Control of lepidopteran pests in rice (Gurr *et al.* 2016 and Horgan 2017)^[2, 3].

Table 1: Reduction of pest and disease incidence in biological control of rice cultivation

Year	Percent reduction in stem borer damage	Percent reduction in leaf folder damage	Percent reduction in sheath blight incidence	Percent reduction in blast incidence
2015-16	89.4	88.2	36.9	68.82
2016-17	87.2	89.4	47.6	81.63
2019-20	88.1	82.80	40.52	88.25
Average	88.23	86.8	41.67	79.57

Table 2: Advantages of biological control in rice cultivation by tribal farmers

Year	Yield (kg/ha)		Yield increase with biological control (%)	Monitory benefit with biological control Rs. / ha	Incremental Benefit Cost with biological control
	Biological control rice cultivation	Traditional rice Cultivation			
2015-16	4025	2100	91.67	19,250	1:4.4
2016-17	4500	2300	95.65	22,000	1:5.63
2019-20	4625	2450	88.78	23,925	1:5.4
Average	4383.3	2283.3	92.03	21,725	1:5.14

Conclusion

Tribal farmers realized the use of Biological control in preventing pests and diseases in rice cultivation and expressed willingness to adopt the technology organic farming for achieving higher yields. Indian tribes set an example of sustainable agriculture. The benefits organic fertilisers have transformed the practice of traditional natural farming into adoption of organic farming practices by the tribal farmers. The change noticed was preparation of organic fertilisers using cow dung, cow urine, jaggery as well as organic pesticides using the leaves and kernels of neem (*Azadirachta indica*). The best part of the story is that the tribal women prefer to use Trichocards and Pseudomonas for the management of pests and diseases in rice. Tribal farmers of arkuvalley and chinthapalli, visakhapatnam district of andhra pradesh state have chosen to produce safe and nutritious food, achieving food security with better livelihood through organic farming. Based on the experience gained Tribal sub plan programme, there is a scope for introduction of more number of programmes for effective, sustainable biological control programs.

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