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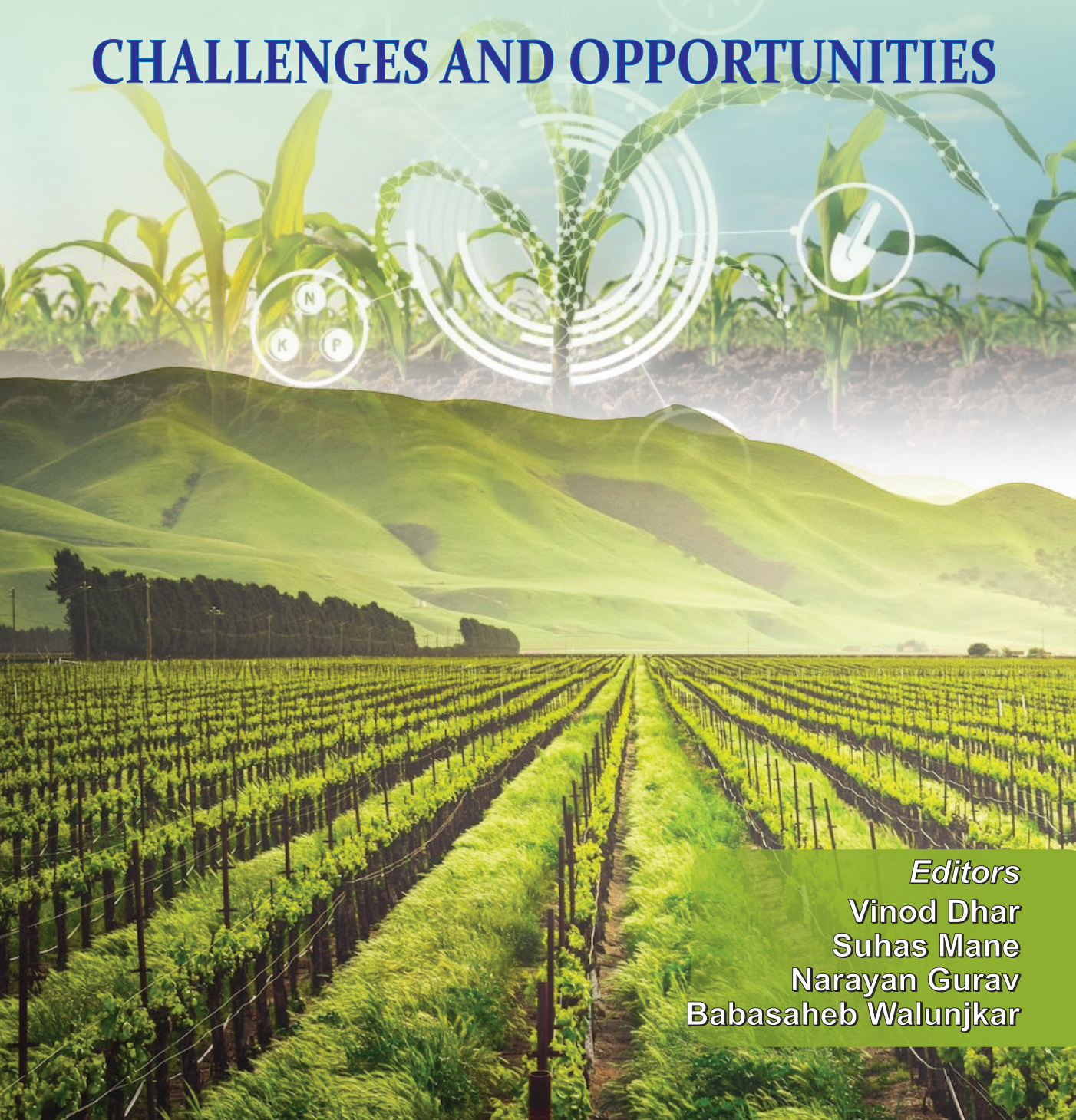
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INNOVATIONS IN AGRICULTURE AND OUTREACH PROGRAMS: CHALLENGES AND OPPORTUNITIES



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Evaluation of Nylon Net for the Management of Rhinoceros Beetle in Coconut Palms in Andhra Pradesh

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ABSTRACT: The coconut rhinoceros beetle (CRB), *Oryctes rhinoceros* Linnaeus (Coleoptera: Scarabaeidae) is one of the most destructive insect pests of coconut and other palm species. The adult beetle bores into the palm crown, damaging the developing fronds and creating distinctive V-shaped notches, which affect tree development and yield. Detection can be difficult due to the beetle's nocturnal activity and residence within trees. During 2022 and 2023, this experiment was carried out to evaluate the effectiveness of the nylon netting technology for management of rhinoceros beetle at ICAR-AICRP on Palms, Dr. YSRHU-Horticultural Research Station, Ambajipeta centre, Dr.B.R. Ambedkar Konaseema District, Andhra Pradesh. A total of 30 coconut palms with age of 4-6 years old were selected (T1) and a separate control (T2) also maintained. The method of treatment which includes Wrapping the spear leaf base with 2-3 adjacent leaf base with nylon fish nets (size – 3.2 x 3.4mm mesh), When new leaf emerges, nylon fish net has loosened and rewrapped suitable to the newly emerged leaf was implemented in the plot as per the experimental protocol.

Pre-count observations on leaf damage by rhinoceros beetle were recorded in both the treatments during April, 2022. The post treatment observations were recorded on leaf damage and number of adult beetles trapped on nylon net. The data on percent leaf damage was recorded at weekly intervals. Results revealed that there is a significant difference with respect to percent leaf damage ranged in T1- treatment (12.29%) and adults beetle trapped on nylon net (0.08 nos.) were observed. However, maximum leaf damage (50.51%) was found in T2-untreated palms (control). The T1- treated palms with nylon net treatment was found significantly superior over T2- untreated control in respect of leaf damage by rhinoceros beetle in coconut. T1- treatment trapped maximum adult's population, which ranges from 0.08 to 0.09 beetles/ week. Similar trends were noticed in every month during both the years. The Nylon net wrapped treatment was found effective to safeguard the juvenile coconut palms from infestation by rhinoceros beetle compared to control plot.

Keywords: Rhinoceros beetle, Coconut, Eco-friendly, Nylon net, Juvenile palms, Andhra Pradesh.

INTRODUCTION

Coconut is a versatile crop grown all over the world, especially performs well in hot humid tropical climates. India is the third largest producer of coconut after Philippines and Indonesia accounting for three-fourth of the global coconut production. Around 12 million people are dependent on coconut farming and its allied activities. It plays a major role in contributing to India's Gross Domestic Product (GDP) as an important source of edible oil and in agro-based raw material for multifarious industries. In India, 91 per cent of the total coconut production falls within four southern states viz., Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. Other states, such as West Bengal, Odisha, Maharashtra, Gujarat and Goa and those in the North East (Tripura and Assam) account for the remaining production. In Andhra Pradesh, Coconut is grown in an area of 1.06 lakh hectares producing 17.097 lakh nuts with a productivity of 14, 500 nuts per hectare.

Coconut is attacked by at least 830 insect and mite species, 173 fungi and 78 species of nematodes, significantly affecting the productivity. Damage by insects, mite and vertebrate pests induces a crop loss as high as 30 per cent in palms. In addition to the increased trade and transport and as a victim of climate change, advent of alien invasive species has become quite rampant in coconut system. The key pests of coconut include rhinoceros beetle (*Oryctes rhinoceros* Linn.), red palm weevil (*Rhynchophorus ferrugineus* Oliv.), black headed caterpillar (*Opisina arenosella* Wlk.), white grub (*Leucopholis coneophora* Burm.) together with the invasive pests viz., coconut eriophyid mite (*Aceria guerreronis* Keif.), rugose spiraling whitefly (*Aleurodicus rugioperculatus* Martin) and nesting whiteflies (*Paraleyrodes bondari* Peracchi and *Paraleyrodes minei* Iaccarino) which are emerging in serious proportions in the country. Among these key pests of coconut, Rhinoceros beetle, *Oryctes rhinoceros* is the cosmopolitan pest attacking palms in all coconut growing regions and in all the seasons worldwide. Its occurrence in India is observed in all the coconut growing states (Rethinam and Singh, 2007). This pest not only attacks coconut but also infests other palm species. The adult beetle attack palms of all ages, but they prefer to feed on young palms under the age of 10 to 15 year. The adult beetle bores into the palm crown, damaging the developing fronds and creating distinctive V-shaped notches, which affect tree development and yield. In case of severe attack, all the leaves and tender portion of the crown shows injuries made by the beetle; chewed fibrous material is present in the crown or near the bored hole. Detection can be difficult due to the beetle's nocturnal activity and residence within trees. Apart from feeding damage, they serve as pre-disposers for red palm weevil, *Rhynchophorus ferrugineus* infestation, bud rot disease caused by *Phytophthora palmivora* (Chakravarthy *et al.*, 2014). Repeated damage done by CRD adults to the meristem on juvenile palm is lethal (Rajan *et al.*, 2009; Josephraj Kumar *et al.*, 2019). To avoid the damage and losses by rhinoceros beetle in coconut, Nylon net technology-an eco friendly approach of pest management was evaluated

MATERIAL AND METHODS

During 2022 and 2023, this experiment was carried out to evaluate the effectiveness of the

nylon net technology for management of rhinoceros beetle at ICAR-AICRP on Palms, Dr.YSRHU-Horticultural Research Station, Ambajipeta centre, Dr.B.R.Ambedkar Konaseema District, Andhra Pradesh. A total of 30 coconut palms with age of 4-6 years old were selected (T1) and a separate control (T2) also maintained. The method of treatment which includes Wrapping the spear leaf base with 2-3 adjacent leaf base with nylon fish nets (size – 3.2 x 3.4mm mesh), When new leaf emerges, nylon fish net has loosened and rewrapped suitable to the newly emerged leaf was implemented in the plot as per the experimental protocol. Pre-count observations on leaf damage by rhinoceros beetle were recorded in both the treatments during April 2022. The post treatment observations were recorded on leaf damage and number of adult beetles trapped on nylon net. The data on percentage leaf damage was recorded at weekly intervals.

RESULTS

During 2022, Results revealed that, there is a significant difference with respect to percent leaf damage in T1-treatment (22.24%) adults beetle trapped on nylon net (0.06 nos.) were observed.

However, maximum leaf damage (47.80%) was found in T2-untreated palms (control) Table 1.

Table 1: Assessment of nylon net for the management of rhinoceros beetle infesting coconut at ICAR-AICRP on palms, Dr YSRHU- HRS, Ambajipeta during 2022

Month	Leaf damage by RB (%)		RB adults trapped on Net/palm (Nos.)
	Treatment	Control	
April	31.81	32.50	0.07
May	31.51	38.46	0.06
June	30.13	42.85	0.07
July	27.57	46.15	0.10
August	22.44	52.50	0.07
September	19.49	56.25	0.06
October	15.81	54.55	0.07
November	12.92	55.12	0.03
December	8.47	51.85	0.03
Mean + SE	22.24 + 2.87	47.80 + 2.78	0.06 + 0.01
Sig(p=0.05)	Sig		
‘T’ - Value	-4.742		
‘P’ - Value	0.0015		

- The mean values in the table represent means of percent leaf and spindle damage.
- Figures in parentheses are analyzed by using paired T-test.
- Means followed by significantly different from each other ($P>0.05$) using paired T-test.

During 2023, Results revealed that, there is a significant difference with respect to percent leaf damage ranged in T1- treatment (12.29%) and adults beetle trapped on nylon net (0.08 nos.) were observed. However, maximum leaf damage (50.51%) was found in T2-untreated palms (control). The T1- treated palms with nylon net treatment was found significantly superior over T2- untreated control in respect of leaf damage by rhinoceros beetle in coconut. T1- treatment trapped maximum adult's population, which ranges from 0.08 to 0.09 beetles/ week. Similar trends were noticed in every month during both the years (Table 2).

Table 2: Assessment of nylon net for the management of rhinoceros beetle infesting coconut at ICAR-AICRP on palms, Dr YSRHU- HRS, Ambajipeta during 2023

Month	Leaf damage by RB (%)		RB adults trapped on Net/palm (Nos.)
	Treatment	Control	
January	6.52	48.25	0.07
February	5.15	44.25	0.10
March	4.25	45.45	0.07
April	9.28	46.38	0.10
May	13.85	46.52	0.07
June	14.28	48.58	0.00
July	16.45	49.67	0.00
August	17.25	50.12	0.03
September	19.45	52.25	0.03
October	16.21	54.10	0.00
November	14.25	58.26	0.00
December	10.62	62.40	0.00
Mean + SE	12.29 + 1.45	50.51 + 1.56	0.08 + 0.01
Sig(p=0.05)	Sig		
'T' – Value	-22.83		
'P' - Value	< 0.005		

- Values given are mean of 30 palms
- The mean values in the table represent means of percent leaf damage.
- Figures in parentheses are analyzed by using paired T-test.
- Means followed by significantly different from each other ($P > 0.05$) using paired T-test.

DISCUSSION

This study revealed that loose wrapping of unopened spear leaf and topmost adjacent two to four leaf bases with nylon nets significantly reduced the leaf damage due to beetles in juvenile

palms in both the years (from April 2022 to December 2023). The use of nylon nets prevented the entry of adult beetles into the spear leaf area for feeding and inflicting damage, thereby strongly acting as a physical barrier. The percent leaf damage was significantly reduced from 31.81% to 8.47% following net protection during 2022 compared to percent leaf damage increase from 32.50% to 51.85% in control palms. Similar trend followed in 2023. present findings are in accordance with the findings of Chandrashekhar *et al.*, 2023 reported that data indicated that the minimum leaf damage (4.9 %), spindle damage (5.8%) and adults beetle trapped on nylon net (0.26 nos.) were observed in T1- treated palms. However, maximum leaf and spindle damage were found 46.5 and 20.2 per cent, respectively in T2-untreated palms. Sujithra *et.al.*, 2022 also reported that use of nylon nets as a pest exclusion barrier guarded the young palms from beetle attack and additionally acted as passive trap by entrapping 20.6 beetles/week/120 palms without any insecticidal intervention.

CONCLUSION

The Nylon net wrapped treatment was found effective to safeguard the juvenile coconut palms from infestation by rhinoceros beetle compared to control plot. This technology as a pest exclusion barrier not only restricted the pest entry but also acted as a tool for passive trapping. It is best suitable in the organic/ Natural farming system to manage the pest.

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India ranks second in the world in agricultural production alone, occupying around 12% of world share, after China. India ranks first at global level in the production of some commodities like milk, millets, mango, banana, ginger, etc. Innovations in agriculture are being continuously developed and proving helpful in sustaining agricultural productivity. In recent years, several technological advances and innovations have been introduced to the Indian agricultural sector, such as precision farming, artificial intelligence, drone technology, crop monitoring systems, etc. which have the potential to increase agricultural productivity and there by better income for farmers.

However, some of the challenges viz climate change, limited irrigation, adverse effects of chemicals, shortage of agricultural labour, water scarcity, lack of access to markets, degradation of natural resources, technological gaps, low productivity, low adoption of mechanization, etc. are still posing an obstacle in achieving our goal of enhanced productivity and quality products. A robust agricultural extension policy is essential for ensuring convergence in the pluralistic system to design stakeholder's coordination mechanism and framework - a way-out for agricultural innovations and outreach to end user.



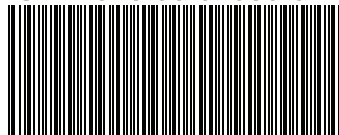
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