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Original Research Article

Management of Rice HISPA (*Dicladispa armigera* Oliv.) Through Use of Neem and Karanj Cake as Organic Manures

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A B S T R A C T

Rice (*Oryza sativa* L.) is one of the most important food crop of the state of Jharkhand. The crop is badly damaged by hispa (*Dicladispa armigera* Oliv.) causing substantially higher loss in yield from 10 to 13 percent. Based on the overall findings of the two years field experimentations, it was found that neem cake (NC) @ 2. 5t/ha proved to be the most effective with the minimum incidence of the pest viz. 2. 55 no. of damaged leaves due to hispa (LDH) per 10 hills (plants) and karanj cake (KC) @ 2. 5 t/ha remained almost at par resulting in 4. 25 LDH/10 hills which, in returns, realizes the grain yield also almost in the similar trends with 41. 50 and 38. 60 q/ha, respectively. It was quite interesting to note that the highest incidence of the pest in terms of damaged leaves to the tune of 26. 18 LDH/10 plants was obtained when the rice plants receive sole use of N@ 80 kg/ha through urea resulting in the lowest yield of 22. 40q/ha. It was also worthy to note that neem and karanj cake @ 0. 5 and 1. 0 t/ha kept as separate treatments supplemented with the rest quantity of N, P, K as per the requirement of RDF (recommended dose of fertilizer) through inorganic source could also be able to be superior over the rice plants receiving N, P, K through other organic and inorganic sources which, ultimately, suffered with lesser incidence of the pest and gave rise to considerably higher yields of grains as well. Based on the overall findings, of the two year's experimentation, it may be concluded that neem and karanj cake, separately, used as organic manure @ 0. 5, 1. 0 and 2. 5t/ha proved to be significantly effective in reducing the incidence of hispa and in realizing the substantially higher yield of grains of rice. As such, the lower dose of neem and karanj cake @ 0. 5 and 1. 0 t/ha could be used as part and parcel in conventional method of rice cultivation and the same to be used at the higher dose @ 2. 5t/ha in the organic method of rice cultivation as one of the major component of IPM for sustainable production of rice.

Keywords

Rice. hispa, *Dicladispa armigera*, neem and karanj cake, grain's yield

Introduction

Rice (*Oryza sativa* L.) is one of the important major and staple food of India including the state of Jharkhand. Rice is grown in Jharkhand in around 18. 00 lakh hectare in wet season. More than half of dozen of major insect pests are causing injuries to rice crop in the field conditions. Hispa (*Dicladispa armigera* Oliv.) is one of them. Adults and grub of hispa feed on the chlorophyll content of leaves of rice plants substantially resulting in white stripes almost parallel to the mid rib of leaves of the crop. Loss in yield of rice is estimated to be varied from 10-15 percent according to the variation in the intensity of the pest attack (Prasad and Prasad, 2006; Krishnaiah *et al.*,

2008). Since grub of hispa is an internal feeder on the leaves, hence efficacy of the chemical insecticides is not much effectives against the pest. Role of the quality host plant nutrition with organic manures with combination of recommended dose of chemical fertilizers with more emphasis on use of neem and karanj oil cakes may be of immense value in reducing the incidence of hispa on rice. But information on these aspects of INM as an integral part of IPM is almost lacking in the literature so far. Hence, the present field study was undertaken with a view to explore the information on this longawaited aspect of IPM in rice –ecosystem.

Materials and Methods

A field experiment was conducted in the rice research farm of Birsa Agricultural University, Ranchi in wet season for two consecutive years, 2013 and 2014 with rice variety, Pusa Basmati-1 in plot size of 5x4 square metre. The experiment was executed in the randomized block design with 13 treatments and 4 replications (Table - 1). Date of seed sowing of rice (var. Pusa Basmati-1) was made on 2nd July and date of transplanting was 26th July during both the years, 2013 and 2014. Harvesting was made on 28 and 30th of November during 2013 and 2014, respectively. The treatment details are shown in Table-1. The treatments comprised of certain organic manures viz. FYM (Farm yard mannure), green manure (GM) in the form of dhaincha (*Sesbania rostrata* L.), vermi compost (VC), neem cake (NC) and karanj cake (KC) and RDF (recommended dose of chemical fertilizers) in the form of their sole and separate use and also in the form of their balanced combinations (Table-1). As such, the crop was raised without any other plant protection measures during both of the experimental years, 2013 and 3014.

Observations

Rice hispa (*D. armigera*) was found to attack rice plant (var. Pusa Basmati -1) in its vegetative stage. Hence, observations on the pest incidence were recorded at 40, 50 and 60 DAT (days after transplanting). The leaves infested with the pest showed characteristics symptoms of white stripes almost parallel to the mid ribs of the affected leaves. As such, total number of leaves damaged due to hispa (LDH) were counted on 10 randomly selected plants (hills) of rice in each treatment and replication during both the years of experimentations, 2013 and 2014 at all the observational dates viz. at 40, 50 and 60 DAT. The mean data on number of leaves damaged by hispa (LDH), recorded at 40, 50 and 60 DAT were calculated during 2013 and 2014. Ultimately, observations recorded on the pest incidence at 40, 50 and 60 DAT of both of the years, 2013 and 2014 were pooled together and the overall mean of the data on LDH/10 hills, received from 2013 and 2014 were again pooled together (Table -1). The pooled data on the incidence of the pest in terms of LDH/10 hills were subjected to the statistical analysis after suitable transformation, Grain's yield were recorded at the maturity of the crop after harvesting the crop. The yield data of both of years of experimentations were pooled together for their proper stayistical analysis for their interpretation and documentation and drawing the conclusions.

Results and Discussion

Rice Hispa (*Dicladispa armigera* Olivier)

A perusal of results (Table-1) revealed that observations on incidence of hispa (*Dicladispa armigera* Olivier), as influenced by different treatments, comprising of use of organic manures and inorganic fertilizers

and their combinations were recorded at 40, 50 and 60 days after transplanting (DAT).

It is clear that incidence of the hispa in terms of leaf damage due to hispa (LDH) was found to increase gradually with advancement of crop growth right from 40 to 60 DAT in all the treatment in general.

The general observations revealed that neem cake, NC applied at 2. 5t/ha proved to be the most effective and karanj cake @ 2. 5 t/ha remained almost at par in terms of enabling the rice plants to receive significantly minimum incidence of the pest at 40, 50 and 60 days after transplanting of rice (Table-1). The overall mean incidence of the pest based on the three observation followed more or less similar trends. The efficacy of two other doses of neem cakes (NC) applied as basal application, apparently remained to be in order of: 1. 0t/ha) >NC (0. 5t/ha) but statistically remained almost at par in terms of reduction of the pest throughout the observational periods.

It is interesting to note that in general, the efficacy of all the organic manures viz. neem and karanj cakes, vermi compost, green manure as well as FYM remained superiorly more effective over the efficacy of inorganic fertilizer viz. RDF (N, P, K @ 80:40:20 kg/ha) and nitrogen alone, through urea (N@80kg/ha) in enabling the rice plants to be more defensive and protective against rice hispa.

However, the efficacy of 50% RDF (N, P, K @40:20:10kg/ha) plus green manure @ 10 t/ha (13. 91 LDH/10 hills) remained statistically superior over those of sole use of 100% RDF (N, P, K @ 80:40:20kg/ha) (24. 63 LDH/10 hills). Neem and Karanj cakes, @ 1. 0t/ha remained inferior to their own higher dose @ 2. 5t/ha) but superior to its lowest dose (0. 5t/ha), in general, in enabling the rice plants protective against hispa almost throughout the observational period (i. e., at 40, 50 and 60 DAT).

The overall mean incidence of hispa also followed more or less similar trends (Table-1). Based on the overall results of three observational periods, it is found that neem cake applied @ 2. 5t/ha enabled the rice plants most protective against the pest having minimum incidence of 2. 55 LDH/10 hills (plants) followed by karanj cake @ 2. 5t/ha (4. 25LDH/10 hills).

Neem cake (NC) @ 1. 0t/ha proved to be superior to KC (1. 0t/ha), NC (0. 5t/ha); however neem cake applied @ 0. 5t/ha remained at par with karanj cake @ 1. 0t/ha and superior to karanj cake @ 1. 0t/ha in terms of reducing the incidence of hispa.

Accordingly, extent of leaf damage caused by hispa (LDH) ranged from minimum of 2. 55 LDH/10 hills (NC@ 2. 5 t/ha) to the maximum of 26. 18 LDH/10 hills (N@ 80kg/ha through urea). Thus, neem cake @ 2. 5 t/ha remained most effective having minimum leaf damage (2. 55 LDH/10hills) followed by karanj cake @2. 5t/ha (4. 25 LDH /10 hills).

It is quite surprising to note that supplying plant nutrients, N, P, K through combined application of green manure (10t/ha) plus 50% RDF (N, P, K @ 40:20:10kg/ha) could be superiorly more protective against hispa as compared to the rice plants receiving full dose of RDF (N, P, K @ 80:40:20 kg/ha) and sole use of nitrogen (N@80kg/ha) in the form of urea applied separately in the present studies.

Earlier, Islam (1984) reported that neem cake extract has been found to be effective in controlling hispa, (*D. armigera*) infesting rice.

Table.1 Effect of organic and inorganic sources of plant nutrients on the incidence of rice hispa (*Dicladispa armigera*) infesting rice (Pusa Basmati – 1) (Based on pooled mean of experimental results of 2013 and 2014)

S. No.	Treatment combinations	No. of damaged leaves due to hispa (LDH)per 10 hills at			**Overall Mean of LDH / 10hills**	**Yield of rice grains(q/ha)**
	Treatments and doses	40 DAT	50 DAT	60 DAT		
T_1	Use of 100% RDF: NPK(80:40:20)kg/ha	**20.66(26.65)**	**24.50(29.67)**	**27.25(31.47)**	**24.63(29.73)**	35.65
T_2	Use of FYM @10t/ha	18.25(25.29)	17.13(24.43)	24.73(29.80)	21.47(27.55)	28.70
T_3	Use of Green manure (GM)@ 10t/ha	15.48(23.15)	15.23(2295)	21.45(27.59)	16.3545(23.71)	26.56
T_4	GM+50%RDF,N as top dressing in two splits	9.76(18.19)	12.13(20.36)	19.85(26.46)	13.91(21.67)	31.80
T_5	Vermi compost,VC@ 2.5t/ha	7.24(15.56)	10.63(19.00)	14.34(22.22)	10.73(18.92)	27.60
T_6	Karanj cake,KC@2.5t/ha	2.96(9.89)	3.65(11.01)	5.48(13.50)	4.25(11.75)	38.60
T_7	Neem cake,NC@2.5t/ha	1.72(7.49)	2.06(8.23)	3.88(11.32)	2.55(9.01)	41.50
T_8	KC@0.5t/ha+NPK(40:40:20kg/ha)i.e.,rest quantity of N comes through inorganic sources *	4.38(12.04)	8.09(16.48)	10.03(18.44)	7.5(15.65)	34.20
T_9	KC@1.0t/ha+NPK(40:40:20kg/ha)i.e.,rest quantity of N comes through inorganic sources *	4.08(11.61)	5.23(13.18)	7.24(15.56)	5.52(13.45)	36.60
T_{10}	NC@0.5t/ha+NPK(53:40:20kg/ha)i.e.,rest quantity of N comes through inorganic sources *	4.13(11.68)	6.46(14.71)	8.56(17.00)	6.26(14.29)	35.90
T_{11}	NC@.1.0t/ha+NPK(26:40:20kg/ha)i.e.,rest quantity of N comes through inorganic sources *	3.75(11.16)	5.23(13.18)	6.15(14.36)	4.94(12.79)	37.40
T_{12}	$N_{80}P_0K_{O(}$Nitrogen=80kgP_0K_0Kg/ha) through inorganic sources*(urea)in 3 splits	21.85(27.88)	27.08(31.33)	29.61(32.92)	26.18(30.71)	22.40
T_{13}	No use of manures and fertilizers(i.e.,untreated control)	12.38(20.58)	21.44(27.56)	22.60(28.38)	18.40(25.32)	8.95
CD (P=0.05)		(0.25)	(0.49)	(0.44)	(0.87)	3.82

Figures under the parentheses are angular transformed values ; DAT -Days after transplanting; RDF –Recommended doses of fertilizer through inorganic sources (i.e., N: P: K:: 80:40:20Kg/ha) in the form of chemical fertilizers; LDH-Leaf damage due to rice hispa. * Inorganic sources refer to chemical fertilizers.

Recently, Bora and Hazarika (2001) revealed that rice seedlings treated with 8. 0, 1. 6, 2. 4 and 3. 2 per cent neem seed oil (NSO) were not preferred by rice hispa for feeding and oviposition. It was also found that NSO exhibited as an ovicidal toxicant against newly laid eggs of *D. armigera* at the concentrations of 1. 6, 2. 4 and 3. 2 percent. As such, NSO appeared as effective antifeedant and anti ovipositional compound against *D. armigera.* As such finding of Islam (1984), Bora and Hazarika (2001) endorsed the results of the present studies.

More recently, Prasad *et al.*, (2010) observed that among the various organic manures viz. FYM, vermi compost, green manure, neem cake and karanj cake, applied as basal use to supply nutrients to the rice plants, neem and karanj cake @ 2. 5 t/ha remained significantly more effective in reducing the incidence of hispa in rice – ecosystem. Their findings further showed that other organic manures also played remarkable role in suppressing the hispa infestation in rice.

Grains yield

The overall mean of two years experimental results (Table - 1) revealed that sole use of neem cake @ 2. 5 t/ha revealed that the highest yield of rice grains of 41. 5 q/ha was realized by use of NC @2. 5t per hectare, which remained at par with that of the sole use of karanj cake @ 2. 5 t/ha (38. 60q/ha) followed by neem cake @ 1. 0 t/ha plus rest of N, P, K @ 26, 40, 20 kg/ha from the chemical fertilizers (37. 40q/ha), Karanj cake @ 1. 0t/ha plus N, P, K @ 40, 20, 20 kg/ha from the inorganic sources i.e. through fertilizers (36. 60q/ha), neem cake @ 0. 5 t/ha + N, P, K @ 53, 40, 20 kg/ha from inorganic sources (35. 90q/ha) and 100% RDF: N, P, K @ 80, 40, 20 kg/ha (35. 60q/ha). The sole use of N @80 kg/ha through urea resulted to the substantially lower yield of 22. 40 q/ha.

Based on the overall results of the undertaken experimentation, it may be concluded that neem and karanj cake used in the varying doses of 0. 5, 1. 0 and 2. 5 t/ha proved to be significantly effective in reducing the incidence of rice hispa (*D. armigera*) resulting in the substantially higher yields of grains of rice. Hence, the present findings suggested that inclusion of neem and karanj cake as organic manure as a part of INM could be an important component of IPM for the sustainable cultivation of rice

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