Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(6): 960-964

Received: 19-09-2020
Accepted: 21-10-2020

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# Performance of certain indigenous products against pod borers in pigeonpea

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**Abstract**

Pigeonpea (*Cajanus cajan* L. (Millsp.)) is a protein rich tropical grain legume mainly grown in India. It is attacked by more than 300 species of insects. Indiscriminate use of insecticides has lead to development of resistance and resurgence of insect pests along with environmental population. Hence the present study was conducted during *Kharif*, 2017-18 to find out the efficacy of certain indigenous products against pod borers in pigeonpea revealed that recommended insecticidal schedule (RIS) *i.e.*, spraying of neem formulation 1500 ppm @ 5ml/l at 50% flowering, followed by chlorantraniliprole @ 0.3ml/l and flubendiamide @ 0.2 ml/l at 15 days interval, followed by chemical check (chlorpyriphos 20 EC @ 250 g a.i/ha) have recorded less pod damage due to pod borer complex (4.3 and 6.8%, respectively) with highest yield (1958 and 1588 kg/ha, respectively), highest net returns (Rs. 49012/- and 33182/-, respectively) and highest incremental cost benefit ratio (ICBR) (7.04 and 12.64, respectively) over all other treatments. Among different indigenous products, product 3 (Agniastra), followed by 2 (Brahmastra), 4 and 1 (Neemastra) respectively recorded net returns of Rs. 20907/-, 20744/-, 18096/- and 13368/-. However, the product 4, followed by 2, 3 and 1 respectively recorded ICBR of 2.84, 2.51, 2.36, and 2.05. The organic check *i.e.*, NSKE 5% registered net returns of Rs. 18185/- with ICBR of 3.46. Further, it was also found that there was no significant difference between the treatments with regard to yield attributes *viz*., plant height, no. of primary and secondary branches, no. of pods/plant, no. of seeds/ pod and test weight.

**Keywords:** Indigenous products, insecticides, pigeonpea, pod borer complex

## Introduction

Pigeonpea (*Cajanus cajan* L) is a tropical grain legume mainly grown in India and ranks second in area and production and contributes about 90% in the world's pulse production. In India pigeonpea was grown in 4.42 m ha with a production of 3.68 m t and productivity of 832 kg $ha^{-1}$, whereas in Andhra Pradesh, India the area, production and productivity was 2.49 L ha, 1.22 L t and 493 kg $ha^{-1}$, respectively during 2018-19 (AICRP Report, 2019) [1]. More than 300 species of insect pests were reported infesting the crop (Lal and Singh, 1998) [2] of which pod borers *viz*., gram pod borer, *Helicoverpa armigera*, spotted pod borer, *Maruca vitrata* and pod fly, *Melanagromyza obtusa* are very important causing heavy yield loss (Sharma *et al.*, 2011) [3]. Management of pod borers relies heavily on insecticides where the farmers spend a considerable portion of the cost of cultivation in pigeonpea cultivation. Considerable numbers of insecticides have been tested and few of them found effective against the pod borers in pigeonpea (Yadav and Dahiya, 2004) [4]. Estimates show that more than US$ 1 billion have been spent on insecticides to control the pod borers affecting this crop. Further, continuous and excessive use of insecticides, the insect pests have developed a considerable level of resistance to most of the conventional insecticides and also posed a serious health hazards and environmental pollution (Anandprakash *et al.*, 2008) [5]. The present investigations were conducted with an objective to evaluate certain indigenous products against pod borers in pigeonpea.

## Materials and Methods

Field trial was conducted at Regional Agricultural Research Station, Lam, Guntur during *Kharif*, 2017-18 with pigeonpea cv. LRG 52 (Amaravathi). The pigeonpea seeds were sown with a spacing of 150 cm x 20 cm row to row and plant to plant spacing respectively with eight treatments including untreated control as shown below in three replications in a randomized block design (RBD). Eight treatments including five indigenous products, two insecticides and untreated control (Table 1) were sprayed thrice at 15 days interval starting from 50 per cent flowering.

**Table 1:** Treatment details and their preparation

| T. No. | Particulars |
|---|---|
| T1 | Indigenous product 1 (Neemastram) @ 20ml/l: To 100 L of water, add 5L of cow urine, 5kg of cow dung, 5kg of neem leaf pulp. Allow the mixture to ferment for 24 hours. Stir the mixture twice a day. Filter & spray. |
| T2 | Indigenous product 2 (Brahmastram) @ 20 ml/l: To 10L of cow urine, add 3 kgs of neem leaf pulp, 2 kg of papaya leaf pulp, 2 kg of guava leaf pulp, 2kg of castor leaf pulp and 2kg of pungamia leaf pulp. Boil the solution for 10 minutes and allow it to cool for 48 hours. Filter and spray. |
| T3 | Indigenous product 3 (Agniastram) @ 20 ml/l: To 10 L of cow urine, add 1 kg of tobacco leaves, 500 grams of green chilli pulp, 500 grams of garlic pulp and 5 kg of neem leaf pulp. Boil the mixture five times and allow it to cool for 48 hours. Filter and spray. |
| T4 | Indigenous product 4 @ 20ml/l: Take ½ kg each of Neem, Custard apple, Calotropis (Jilledu) and Thutikada (morning glory) leaves. Cut them and add 5 L cow urine and 15 L water. Decompose the leaves for 5 days. Boil till the water and cow urine reduces to half the quantity. Filter and spray. |
| T5 | Neem Seed Kernel Extract (Organic check) @ 50 ml/l<br>Take 5 kg of Neem seed kernel and grind gently to powder it and soak it overnight in 10 liter of water. Stirred with wooden plank in the morning till solution becomes milky white. Filtered through double layer of muslin cloth and made the volume to 100 L. Added 1% detergent. Mix the spray solution well and use. |
| T6 | Chlorpyriphos (Chemical check) @ 2.5 ml/l |
| T7 | Recommended Insecticidal Schedule (RIS): Azadirachtin 1500 ppm @ 5.0 ml/l, followed by chlorantraniliprole 18.5 SC @ 0.3 ml/l and flubendiamide @ 0.2 ml/l |
| T8 | Untreated check (water spray) |

The data on different aspects like, number of *H. armigera*, *M. vitrata* larvae per plant and number of webbings due to *M. vitrata* / plant will be recorded just before spraying and 5 and 10 days after spraying. Cumulative efficacy and reduction over control will be calculated. Per cent pod damage due to *Helicoverpa*, *Maruca*, *Melanagromyza*, data on yield attributes like plant height, no. of primary branches, no. of secondary branches, no. of pods/plant, no. of seeds/pod, test weight etc. along with grain yield (kg/ha) were recorded at the time of harvest. The data obtained was subjected to RBD analysis using AGRES package (Gomez and Gomez, 1984) [6]. The monetary returns and incremental cost-benefit ratio of treatments was also worked out.

## Results and Discussion

All the treatments significantly reduced the *H. armigera* larval population over control. The results showed that recommended insecticidal schedule (RIS) was most effective, followed by chemical check which have registered 85.8 and 57.5 per cent reduction of *H. armigera* larval population over control. The least effective was found to be the indigenous product 4 (37.7%) (Table 2). The results were in concurrence with the findings of Lal and Sachan (1987) [7] who has evaluated the performance of neem seed kernel extract (5%), neem leaf extract (5%) and neem oil along with recommended insecticides against *H.armigera* on pigeonpea and concluded that NSKE 5% had good scope for control of *H.armigera*. Nath and Singh (2006) [8] has evaluated the efficacy of bio-pesticides against *H.armigera* and revealed that pigeonpea + rice, followed by pigeonpea + sorghum sprayed with NSKE 5 per cent at flowering and pod formation stage was found effective in reducing the pod and grain damage (3.6 and 2.6%, respectively). Shekara *et al.* (2014) [9] evaluated the efficacy of bio-rationales against *H.armigera* in chickpea and reported that larval population per ten plants at seven days interval after spraying of Agniastram @ 25 l/ha was 2.70 against 9.00 in untreated control during first spraying. Babu *et al.* (2015) [10] conducted field experiments to evaluate different methods for management of pod borers and recorded higher yields in NSKE sprayed thrice (1258 kg/ha) and one spray of NSKE followed by two sprays of indoxacarb (1257 kg/ha). Meena *et al.*(2018) [11] conducted field experiment to evaluate the efficacy of bio-pesticides against gram pod borer in chickpea and reported minimum pod damage with NSKE (10.41%), followed by azadirachtin (10.84%).

Similarly, the treatments, RIS, chemical check and indigenous product 1 have respectively recorded 67.4, 74.4 and 60.5 per cent reduction of *M. vitrata* larval population over control. The indigenous product 4 was reported to be least effective with 34.7 per cent reduction of larval population over control. Further, the flower damage due to *M. vitrata* was low in RIS, followed by chemical check, which have registered 64.8 and 56.4 per cent reduction of flower damage due to *M. vitrata* over control (Table 3). The results were in agreement with the findings of Ganapathy (1996) [12] who has evaluated insecticides against *M. vitrata* and reported that NSKE 5% and neem oil recorded low larval numbers (1.0 and 1.3/plant), less flower damage (7.7 and 10.4%), webbings (1.5 and 1.5plant) and pod damage (7.7 and 10.4%), respectively. Shivaraju *et al.* (2011) [13] reported that among various indigenous materials evaluated against *M. testulalis* in black gram, NSKE 5% recorded highest mean per cent reduction of larval population (36.26% and 55.34% after 1stand 2nd sprays, respectively). Kanhere *et al.* (2012) [14] conducted field experiment to evaluate the relative efficacy of insecticides against *M. vitrata* and revealed that NSKE 5 per cent (85 to 83% mortality) was statistically on par with endosulfan having highest mortality (89 to 87%).

The results on pod damage due to *M. obtusa* showed that RIS, followed by chemical check have recorded 2.5 and 2.6 per cent pod damage, respectively. Thus both the treatments have resulted in 44.4 and 42.2 per cent reduction over control. Further, it was found that indigenous product 1, 3 and 4 respectively recorded 6.3, 16.7 and 27.4 per cent more pod damage over control. The results were in accordance with the findings of Srivastava and Mahopatra (2003) [15] who has reported that per cent pod damage due to pod fly and pod bug was least (3.0) in plots treated with dimethoate which was on par with dimethoate + NSKE (5.2) and alanycarb (5.9).

The cumulative pod damage due to lepidopteron pod borers was low in RIS, followed by chemical check, indigenous product 2, 4 and 5 which have respectively recorded 1.8, 4.1, 4.3, 4.6 and 4.9 per cent pod damage, there by registered 72.7, 37.9, 34.9, 30.3 and 25.8 per cent reduction over control. Similarly, the pod damage due to pod borer complex i.e., *H. armigera*, *M. vitrata* and *M. obtusa* was low in RIS, followed by chemical check, indigenous product 2 and 4 which have respectively recorded 60.9, 38.2, 21.8 and 17.3 per cent reduction over control (Table 4). The findings were in agreement with Santosh *et al.* (2009) [16] who has evaluated indigenous components against pod borer complex of soyabean and stated that per cent pod damage in Brahmastram 5%, Neemastram and neem oil was 28.06, 36.11 and 37.13 respectively and were superior to untreated check (53.07%). However, significant reduction in pod damage was recorded in standard check chlorpyriphos (19.65%) which was on par with treatment Agniastram 3 per cent (24.63%).

The data collected on different yield attributes *viz*., plant height, no. of primary and secondary branches, no. of pods per plant and no. of seeds per pod and test weight (100 seed weight) has shown that there was no significant difference among the treatments (Table 5)

More grain yield was recorded with RIS (1958 kg/ha), followed by chemical check (1588 kg/ha), indigenous product 3 (1477 kg/ha) and 2 (1463 kg/ha). Thus, the treatments have recorded 1027, 657, 546 and 532 kg/ha more yield over control (931 kg/ha). Net returns were also more in these treatments. However, incremental cost benefit ratio (ICBR) was highest in chemical check (chlorpyriphos @ 2.5 ml/l), followed by RIS (azadirachtin 1500 ppm @ 5.0 ml/l, followed by chlorantraniliprole @ 0.3 ml/l and flubendiamide @ 0.2 ml/l) and organic check (NSKE 5%) with 12.64, 7.04 and 3.46, respectively (Table 6)

**Table 2:** Evaluation of certain indigenous products against *Helicoverpa armigera* in pigeonpea

| T. No. | Treatment details | No. of *H. armigera* larvae / plant | | | | |
|---|---|---|---|---|---|---|
| | | Before spraying | 5 DAS | 10 DAS | Cumulative efficacy | Reduction over Control (%) |
| T1 | Indigenous product 1 (Neemastram) @ 20ml/l) | 2.60 | 1.60 (1.61) | 1.93 (1.71) | 1.77 (1.66) | 49.9 |
| T2 | Indigenous product 2 (Brahmastram) @ 20 ml/l) | 2.80 | 1.53 (1.59) | 1.87 (1.69) | 1.70 (1.64) | 51.8 |
| T3 | Indigenous product 3 (Agniastram) @ 20 ml/l) | 3.80 | 1.47 (1.57) | 2.00 (1.73) | 1.73 (1.65) | 51.0 |
| T4 | Indigenous product 4 @ 20 ml/l | 3.20 | 2.00 (1.73) | 2.40 (1.84) | 2.20 (1.79) | 37.7 |
| T5 | NSKE 5% (Organic Check) | 2.80 | 1.60 (1.61) | 2.13 (1.77) | 1.87 (1.69) | 47.0 |
| T6 | Chlorpyriphos @ 2.5ml/l (Chemical Check) | 3.00 | 1.40 (1.55) | 1.60 (1.61) | 1.50 (1.58) | 57.5 |
| T7 | Azadirachtin 1500 ppm @ 5ml/l - Chlorantraniliprole @ 0.3 ml/l - Flubendiamide @ 0.2 ml/l (RIS) | 2.80 | 0.27 (1.12) | 0.73 (1.32) | 0.50 (1.22) | 85.8 |
| T8 | Control | 3.00 | 3.53 (2.13) | 3.53 (2.13) | 3.53 (2.13) | -- |
| | SEM | 0.107 | 0.044 | 0.040 | 0.029 | -- |
| | SED | 0.151 | 0.063 | 0.056 | 0.041 | -- |
| | CD (P=0.05) | NS | 0.135 | 0.120 | 0.089 | -- |
| | CV (%) | 9.3 | 4.8 | 4.0 | 3.0 | -- |

Figures in parenthesis are SQRT transformed values; DAS: Days after spraying;
RIS: Recommended insecticidal schedule

**Table 3:** Evaluation of certain indigenous products against *Maruca vitrata* in pigeonpea

| Treatment details | No. of *M. vitrata* larvae / plant* | | | | | Flower damage (%) due to *M. vitrata*** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Before spraying | 5 DAS | 10 DAS | Cumulative efficacy | Reduction over control (%) | Before Spraying | 5 DAS | 10 DAS | Cumulative efficacy | Reduction over Control (%) |
| Indigenous product 1 (Neemastram) @ 20ml/l) | 2.40 | 1.35 (1.528) | 1.27 (1.503) | 1.33 (1.527) | 60.5 | 2.9 | 8.7 (17.11) | 11.2 (19.58) | 10.0 (18.40) | 44.1 |
| Indigenous product 2 (Brahmastram) @ 20 ml/l) | 2.80 | 1.76 (1.663) | 1.80 (1.673) | 1.83 (1.683) | 45.7 | 2.7 | 8.4 (16.88) | 12.0 (20.26) | 10.3 (18.67) | 42.5 |
| Indigenous product 3 (Agniastram) @ 20 ml/l) | 1.80 | 1.31 (1.528) | 1.71 (1.642) | 1.53 (1.591) | 54.6 | 2.9 | 8.5 (16.97) | 10.7 (19.10) | 9.6 (18.08) | 46.4 |
| Indigenous product 4 @ 20 ml/l | 2.33 | 1.78 (1.663) | 2.10 (1.770) | 2.20 (1.722) | 34.7 | 2.5 | 9.3 (17.68) | 12.5 (20.73) | 10.9 (19.27) | 39.1 |
| NSKE 5% (Organic Check) | 2.60 | 1.26 (1.494) | 1.77 (1.662) | 1.53 (1.591) | 54.6 | 2.9 | 7.9 (16.36) | 10.6 (18.95) | 9.3 (17.75) | 48.1 |
| Chlorpyriphos @ 2.5ml/l (Chemical Check) | 2.40 | 1.11 (1.449) | 1.28 (1.506) | 1.20 (1.483) | 64.4 | 2.6 | 6.4 (14.58) | 9.2 (17.67) | 7.8 (16.24) | 56.4 |
| Azadirachtin 1500 ppm @ 5ml/l - Chlorantraniliprole @ 0.3 ml/l - Flubendiamide @ 0.2 ml/l (RIS) | 2.00 | 0.87 (1.365) | 1.27 (1.504) | 1.10 (1.448) | 67.4 | 2.6 | 5.5 (13.52) | 7.0 (15.34) | 6.3 (14.52) | 64.8 |
| Control | 3.13 | 3.16 (2.040) | 3.45 (2.113) | 3.37 (2.089) | -- | 2.6 | 14.1 22.04) | 21.5 (27.64) | 17.9 (25.00) | -- |
| SEM | 0.132 | 0.025 | 0.038 | 0.027 | -- | 0.198 | 0.452 | 0.612 | 0.401 | -- |
| SED | 0.186 | 0.035 | 0.054 | 0.038 | -- | 0.281 | 0.639 | 0.866 | 0.568 | -- |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CD (P=0.05) | NS | 0.076 | 0.117 | 0.081 | -- | NS | 1.370 | 1.858 | 1.217 | -- |
| CV (%) | 12.4 | 2.7 | 4.0 | 2.8 | -- | 3.6 | 4.6 | 5.3 | 3.8 | -- |

* Figures in parenthesis are SQRT transformed values; RIS: Recommended Insecticidal schedule; ** Figures in parenthesis are arc sine percentage transformed values; DAS: Days after spraying; RIS: Recommended insecticidal schedule

**Table 4:** Evaluation of certain indigenous products against *Melanagromyza obtusa* in pigeonpea

| T. No. | Treatment details | Pod damage (%) due to *M. obtusa* | Increase (+) or decrease (-) over Control (%) | Pod damage (%) due to lepidopteron pod borers | Reduction over control (%) | Pod damage (%) due to pod borer complex | Increase (+) or decrease (-) over Control (%) |
|---|---|---|---|---|---|---|---|
| T1 | Indigenous product 1 (Neemastram) @ 20ml/l) | 4.8 (12.62) | +6.3 | 5.5 (13.55) | 16.7 | 10.3 (18.70) | -6.4 |
| T2 | Indigenous product 2 (Brahmastram) @ 20 ml/l) | 4.3 (11.84) | -4.4 | 4.3 (11.91) | 34.9 | 8.6 (16.95) | -21.8 |
| T3 | Indigenous product 3 (Agniastram) @ 20 ml/l) | 5.4 (13.43) | +16.7 | 5.6 (13.49) | 15.2 | 11.0 (19.28) | -- |
| T4 | Indigenous product 4 @ 20 ml/l | 4.5 (12.27) | 0.0 | 4.6 (12.29) | 30.3 | 9.1 (17.54) | -17.3 |
| T5 | NSKE 5% (Organic Check) | 6.2 (14.41) | +27.4 | 4.9 (12.78) | 25.8 | 11.1 (19.48) | +0.9 |
| T6 | Chlorpyriphos @ 2.5ml/l (Chemical Check) | 2.6 (9.31) | -42.2 | 4.1 (11.71) | 37.9 | 6.8 (15.07) | -38.2 |
| T7 | Azadirachtin 1500 ppm @ 5ml/l – Chlorantraniliprole @ 0.3 ml/l - Flubendiamide @ 0.2 ml/l (RIS) | 2.5 (9.09) | -44.4 | 1.8 (7.53) | 72.7 | 4.3 (11.88) | -60.9 |
| T8 | Control | 4.5 (12.13) | -- | 6.6 (14.80) | -- | 11.0 (19.36) | -- |
| | SEM | 0.865 | -- | 0.851 | -- | 1.045 | -- |
| | SED | 1.223 | -- | 1.203 | -- | 1.478 | -- |
| | CD (P=0.05) | 2.624 | -- | 2.581 | -- | 3.170 | -- |
| | CV (%) | 12.6 | -- | 12.0 | -- | 10.5 | -- |

Figures in parenthesis are arc sin percentage transformed values; RIS: Recommended insecticidal schedule

**Table 5:** Yield attributes in evaluation of certain indigenous products in pigeonpea

| T. No. | Treatment details | Plant height (mts) | Primary branches / plant (no.) | Secondary branches / plant (no.) | Pods / plant (no.) | Seeds / pod (no.) | Test weight (g) |
|---|---|---|---|---|---|---|---|
| T1 | Indigenous product 1 (Neemastram) @ 20ml/l) | 1.82 | 1.67 | 19.0 | 552 | 2.26 | 9.83 |
| T2 | Indigenous product 2 (Brahmastram) @ 20 ml/l) | 1.87 | 1.67 | 20.1 | 613 | 2.03 | 10.22 |
| T3 | Indigenous product 3 (Agniastram) @ 20 ml/l) | 1.91 | 1.78 | 20.7 | 671 | 2.23 | 10.50 |
| T4 | Indigenous product 4 @ 20 ml/l | 1.86 | 1.55 | 19.0 | 504 | 2.27 | 9.95 |
| T5 | NSKE 5% (Organic Check) | 1.89 | 1.45 | 19.5 | 578 | 2.02 | 10.11 |
| T6 | Chlorpyriphos @ 2.5ml/l (Chemical Check) | 1.99 | 1.44 | 20.3 | 692 | 2.24 | 10.28 |
| T7 | Azadirachtin 1500 ppm @ 5ml/l - Chlorantraniliprole @ 0.3 ml/l - Flubendiamide @ 0.2 ml/l (RIS) | 1.98 | 1.55 | 20.5 | 713 | 2.25 | 10.56 |
| T8 | Control | 1.91 | 1.33 | 17.4 | 485 | 1.99 | 9.78 |
| | SEM | 0.091 | 0.152 | 1.11 | 101.3 | 0.268 | 0.294 |
| | SED | 0.129 | 0.215 | 1.57 | 143.3 | 0.379 | 0.415 |
| | CD (P=0.05) | NS | NS | NS | NS | NS | NS |
| | CV (%) | 8.3 | 17.0 | 9.8 | 29.2 | 21.5 | 5.0 |

NS: Non-significant; RIS: Recommended insecticidal schedule.

**Table 6:** Economics of certain indigenous products against pod borers in pigeonpea

| T. No. | Treatment details | Yield (kg/ha) | Increase in yield over control (kg/ha) | Cost of increased yield (Rs.) [A] | Plant protection cost /ha # (Rs.) [B] | Net returns over control (Rs.) [A-B] | ICBR [A-B] [B] |
|---|---|---|---|---|---|---|---|
| T1 | Indigenous product 1 (Neemastram) @ 20ml/l) | 1296 | 365 | 19893 | 6525 | 13368 | 2.05 |
| T2 | Indigenous product 2 (Brahmastram) @ 20 ml/l) | 1463 | 532 | 28994 | 8250 | 20744 | 2.51 |
| T3 | Indigenous product 3 (Agniastram) @ 20 ml/l) | 1477 | 546 | 29757 | 8850 | 20907 | 2.36 |
| T4 | Indigenous product 4 @ 20 ml/l | 1380 | 449 | 24471 | 6375 | 18096 | 2.84 |
| T5 | NSKE 5% (Organic Check) | 1361 | 430 | 23435 | 5250 | 18185 | 3.46 |
| T6 | Chlorpyriphos @ 2.5ml/l (Chemical Check) | 1588 | 657 | 35807 | 2625 | 33182 | 12.64 |
| T7 | Azadirachtin 1500 ppm @ 5ml/l Chlorantraniliprole @ 0.3 ml/l - Flubendiamide @ 0.2 ml/l (RIS) | 1958 | 1027 | 55972 | 6960 | 49012 | 7.04 |
| T8 | Control | 931 | -- | -- | -- | -- | -- |
| | SEM | 80.03 | -- | -- | -- | -- | -- |
| | SED | 113.16 | -- | -- | -- | -- | -- |
| | CD (P=0.05) | 242.72 | -- | -- | -- | -- | -- |
| | CV (%) | 9.4 | -- | -- | -- | -- | -- |

ICBR: Incremental Cost Benefit Ratio; MSP of Redgram (Feb, 2018): Rs. 54.50/- per kg;
# Plant protection cost includes labour cost for preparation of products and spray boy cost for spraying

## Conclusion

It was concluded that recommended insecticidal schedule (RIS) (spraying of neem formulation 1500 ppm @ 5ml/l at 50% flowering, followed by chlorantraniliprole @ 0.3ml/l and flubendiamide @ 0.2 ml/l at 15 days interval), followed by chemical check (chlorpyriphos 20 EC @ 2.5 ml/l) have recorded less pod damage due to pod borer complex with more yield and incremental cost benefit ratio (ICBR). Among different indigenous products, product 3 (Agniastra) and 2 (Brahmastra) have recorded considerably more net returns. However, the organic check *i.e.*, NSKE 5% has registered highest ICBR.

**Acknowledgement**
Authors are highly thankful to Acharya N. G. Ranga Agricultural University and Regional Agricultural Research Station, Lam, Guntur for providing necessary facilities for conducting the study.

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