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# EFFICACY OF INSECTICIDES AND NEEM SEED KERNEL EXTRACT AGAINST *HELICOVERPA ARMIGERA* (HUBNER) IN CHICKPEA

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## ABSTRACT

Eight insecticides and NSKE along with control [$T_1$=NSKE 5% @ 25 kg/ha followed by NSKE 5% @ 25 kg/ha, $T_2$= Endosulfan 35 EC @ 1.5 l/ha followed by Endosulfan 35 EC @ 1.5 l/ha, $T_3$= Acephate 75 SP @ 500g/ha followed by Acephate 75 SP @ 500g/ha, $T_4$= NSKE 5% @ 25 kg/ha followed by Endosulfan 35 EC @ 1.5 l/ha, $T_5$= NSKE 5% @ 25 kg/ha followed by Acephate 75 SP @ 500g/ha, $T_6$= Endosulfan 35 EC @ 1.5 l/ha followed by NSKE 5% @ 25 kg/ha, $T_7$= Acephate 75 SP @ 500g/ha followed by NSKE 5% @ 25 kg/ha and $T_8$= control] were evaluated for their efficacy against gram pod borer [(*Helicoverpa armigera* Hubner)] at Agricultural Research Station, Ummedganj, Kota (Rajasthan) during *rabi* 2004-05 and *rabi* 2005-06. Pod borer was effectively controlled by two sprays of Acephate 75 SP @ 500g/ha (1.15 larvae/plant and 13.99 per cent pod damage) followed by Endosulfan 35 EC @ 1.5 l/ha two sprays (1.23 larvae/plant and 15.70 per cent pod damage) as compared to untreated check (3.53 larvae/plant and 27.97 per cent pod damage). Maximum grain yield (1599 kg/ha) was also recorded with two sprays of Acephate 75 SP @ 500g/ha followed by two sprays of Endosulfan 35 EC @ 1.5 l/ha (1400 kg/ha) as against 440 kg/ha in absolute control.

**Key words:** *Helicoverpa armigera* (Hubner) NSKE, Chickpea, efficacy

Chickpea (*Cicer arietinum* Linn.) is a major *rabi* season pulse crop in terms of both area and production. The world's total production of chickpea is around 8.5 million metric tons annually and is grown over 10 million hectares of land approximately. The desi type chickpea contribute to around 80 per cent and the Kabuli type around 20 per cent of the total production. India is the largest producer of chickpea contributing about 70 per cent of the world's total production. Chickpea is grown in the drier and marginal areas of the country as they are best suited for its production. Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra and Andhra Pradesh are major chickpea producing states in India. On an average 30-80 per cent crop losses occur in pulses due to ravages of insect pests costing Rs. 4000 to 5000 crores (Asthana *et al.*, 1997).

The gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is a dominant and serious pest of chickpea in India (Pimpert, 1990). Sachan (1987) reported that pod damage in the crop due to *H. armigera* could go up to the extent of 100 per cent in India. According to Read and Pawar (1982), a single larva of gram pod borer alone can destroy 30-46 pods before the maturity.

The present study therefore, was undertaken to evaluate the combined effect of insecticides and NSKE on the pod borer, chickpea yield and benefit cost ratio under agro climatic conditions of Humid South Eastern plain zone of Rajasthan.

## MATERIALS AND METHODS

Field experiments were conducted at experimental Farm of Agricultural Research Station, Ummedganj, Kota during *rabi* 2004-05 and *rabi* 2005-06 in randomized block design (RBD). The variety, Dahod yellow was sown in the second week of November keeping 30 cm row-to-row and 10 cm plant-to-plant spacing in plots 4.2 × 5.0 m. There were eight treatments: $T_1$= NSKE 5% @ 25 kg/ha followed by NSKE 5% @ 25 kg/ha, $T_2$= Endosulfan 35 EC @ 1.5 l/ha followed by Endosulfan 35 EC @ 1.5 l/ha, $T_3$= Acephate 75 SP @ 500g/ha followed by Acephate 75 SP @ 500g/ha, $T_4$= NSKE 5% @ 25 kg/ha followed by Endosulfan 35 EC @ 1.5 l/ha, $T_5$=NSKE 5% @ 25 kg/ha followed by Acephate 75 SP @ 500g/ha, $T_6$= Endosulfan 35 EC @ 1.5 l/ha followed by NSKE 5% @ 25 kg/ha, $T_7$= Acephate 75 SP @ 500g/ha followed by NSKE 5% @ 25 kg/ha and $T_8$= control. The treatments were applied 25 and 45 days after sowing. Ten

plants were randomly selected from each plot and tagged. The population of gram pod borer was counted on tagged plants after seven days of treatment application and mean pod damage was recorded at physiological maturity stage. Grain yield was recorded from each replication after the harvest of the crop.

## RESULTS AND DISCUSSION

**Larval population.** The data recorded and presented in Table 1 on gram pod borer [(*Helicoverpa armigera* Hubner)] (population/plant) during *rabi* 2004-05 revealed that after seven days of treatment, the population varied from 1.13 to 2.36 larvae/plant among different treatments as against 3.43 larvae/plant in untreated control. The treatment of two sprays of Acephate 75 SP @ 500g/ha followed by NSKE 5% @ 25 kg/ha was most effective against pod borer where only 1.13 larvae/plant were recorded.

During *rabi* 2005-06, it is evident from Table 1, that two sprays of Acephate 75 SP @ 500g/ha was most effective against gram pod borer where only 1.16 larvae/plant were observed after seven days of treatment. It was followed by two sprays of Endosulfan 35 EC @ 1.5 l/ha (1.20 larvae/plant) while in untreated control 3.63 larvae/plant were found. In rest of the treatments, pod borer population varied from 1.60 to 2.10 larvae/plant.

Mean larval population of gram pod borer during two consecutive cropping seasons *i.e. rabi* 2004-05 and 2005-06 presented in Table 1 indicated that after seven days of treatments, gram pod borer population varied from 1.15 to 2.23 larvae/plant in different insecticidal and NSKE treatments; whereas, 3.53 larvae/plant were recorded in untreated control. The treatment of two sprays of Acephate 75 SP @ 500g/ha was most effective against pod borer where only 1.15 larvae/plant were recorded.

**Pod damage.** The data recorded on mean pod damage during *rabi* 2004-05 presented in Table 1 revealed that at physiological maturity stage, pod damage varied from 14.75 to 20.97 per cent in different treatments; whereas, 28.47 per cent pod damage was recorded in untreated control. Two sprays of Acephate 75 SP @ 500g/ha was found most effective against gram pod borer where only 14.75 per cent pod damage was recorded followed by two sprays of Endosulfan 35 EC @ 1.5 l/ha (16.56 per cent pod damage) and statistically no significant difference was observed between them.

The data recorded on gram pod borer (per cent pod damage) during *rabi* 2005-06 presented in Table 1 revealed that at physiological maturity stage, pod damage varied from 13.22 to 21.73 per cent in different in treatments; whereas, 27.46 per cent pod damage was recorded in untreated control. Among the treatments, two sprays of Acephate 75 SP @ 500g/ha was most effective against gram pod borer where only 13.22 per cent pod damage was recorded followed by two sprays of Endosulfan 35 EC @ 1.5 l/ha (14.84 per cent pod damage).

Mean pod damage during two consecutive cropping seasons presented in Table 1 indicated that a physiological maturity stage, pod damage varied from 13.99 to 21.35 per cent pod damage in different treatments as against 27.97 per cent in untreated control. Among the treatments, the treatment of two sprays of Acephate 75 SP @ 500g/ha was most effective against gram pod borer where only 13.99 per cent pod damage was recorded followed by two sprays of Endosulfan 35 EC @ 1.5 l/ha (15.70 per cent pod damage).

**Grain yield.** The data recorded on grain yield during *rabi* 2004-05 presented in Table 1 revealed that two sprays of Acephate 75 SP @ 500g/ha was most effective with maximum grain yield (1415 kg/ha) and was significantly superior over rest of the treatments. The grain yield in rest of the treatments varied from 780 to 1030 kg/ha while only 365 kg/ha in untreated check. Similar results were also obtained during 2005-06. Two sprays of Acephate 75 SP @ 500g/ha was most effective with maximum grain yield (1765 kg/ha). The grain yield in rest of the treatments varied from 880 to 1150 kg/ha while 515 kg/ha, in untreated check.

**Economic evaluation.** Data presented in Table 2 revealed that maximum return, profit over control, net profit B: C ratio was recorded in the treatment of two sprays of Acephate 75 SP @ 500g/ha.

Present findings conform the findings of Neharkar *et al.* (1999), who reported that Acephate 75 SP as most effective against *H. armigera* in pigeonpea. Singh *et al.* (2005) also reported two sprays of Acephate 75 SP @ 2.0 kg/ha followed by two sprays of Endosulfan 35 EC @ 2.5 l/ha most effective against *H. armigera* in tomato.

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**Table 1. Effect of insecticides and NSKE alone and with combination against gram pod borer, *Helicoverpa armigera* Hubner**

| Tr. No. | Treatments | Larval population/plant | | | Per cent pod damage | | | Grain yield (kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2004-05 | 2005-06 | Mean | 2004-05 | 2005-06 | Mean | 2004-05 | 2005-06 | Mean |
| $T_1$ | NSKE 5% @ 25 kg/ha followed by NSKE 5% @ 25 kg/ha | 2.36 | 2.10 | 2.23 | 20.97 | 21.73 | 21.35 | 780 | 880 | 830 |
| $T_2$ | Endosulfan 35 EC @ 1.5 l/ha followed by Endosulfan 35 EC @ 1.5 l/ha | 1.26 | 1.20 | 1.23 | 16.56 | 14.84 | 15.70 | 1150 | 1650 | 1400 |
| $T_3$ | Acephate 75 SP @ 500 g/ha followed by Acephate 75 SP @ 500 g/ha | 1.13 | 1.16 | 1.15 | 14.75 | 13.22 | 13.99 | 1415 | 1765 | 1590 |
| $T_4$ | NSKE @ 5% followed by Endosulfan 35 EC @ 1.5 l/ha | 1.73 | 1.63 | 1.68 | 20.95 | 19.40 | 20.18 | 815 | 1030 | 923 |
| $T_5$ | NSKE @ 5% followed by Acephate 75 SP @ 500 g/ha | 1.53 | 1.60 | 1.57 | 20.25 | 18.57 | 19.41 | 900 | 1065 | 983 |
| $T_6$ | Endosulfan 35 EC @ 1.5 l/ha followed by NSKE @ 5% | 1.33 | 1.70 | 1.52 | 18.41 | 19.36 | 18.89 | 1015 | 1100 | 1058 |
| $T_7$ | Acephate 75 SP @ 500 g/ha followed by NSKE @ 5% | 1.13 | 1.73 | 1.43 | 18.12 | 17.44 | 17.78 | 1030 | 1150 | 1090 |
| $T_8$ | Control | 3.43 | 3.63 | 3.53 | 28.47 | 27.46 | 27.97 | 365 | 515 | 440 |
| | S.Em. ± | 0.15 | 0.17 | – | 0.83 | 0.94 | – | 69.50 | 60 | – |
| | C.D. (P=0.05) | 0.44 | 0.51 | – | 2.51 | 2.86 | – | 211 | 180 | – |

**Table 2. Economics and benefit cost ratio of insecticides and NSKE in chickpea**

| Tr. No. | Treatments | Return (Rs./ha) | Cost of input and labour | Profit over control | Net profit | B: C ratio |
|---|---|---|---|---|---|---|
| $T_1$ | NSKE 5% @ 25 kg/ha followed by NSKE 5% @ 25 kg/ha | 18260 | 900 | 8580 | 7680 | 0.79 |
| $T_2$ | Endosulfan 35 EC @ 1.5 l/ha followed by Endosulfan 35 EC @ 1.5 l/ha | 30800 | 1160 | 21120 | 19960 | 2.061 |
| $T_3$ | Acephate 75 SP @ 500 g/ha followed by Acephate 75 SP @ 500 g/ha | 34980 | 970 | 25300 | 24330 | 2.513 |
| $T_4$ | NSKE @ 5% followed by Endosulfan 35 EC @ 1.5 l/ha | 20295 | 1030 | 10615 | 9585 | 0.99 |
| $T_5$ | NSKE @ 5% followed by Acephate 75 SP @ 500 g/ha | 21615 | 935 | 11935 | 11000 | 1.136 |
| $T_6$ | Endosulfan 35 EC @ 1.5 l/ha followed by NSKE @ 5% | 23265 | 1030 | 13585 | 12555 | 1.297 |
| $T_7$ | Acephate 75 SP @ 500 g/ha followed by NSKE @ 5% | 23980 | 935 | 1430 | 13365 | 1.380 |
| $T_8$ | Control | 9680 | – | – | – | – |

Gram = Rs. 2200, NSKE = Rs. 10/kg, Endosulfan = Rs. 253/1 and Acephate = Rs. 570/kg and labour charge = Rs. 400/ha.

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