Yield and yield attributes of chickpea as affected by different insecticides used in storage

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Abstract

Field experiments were carried out in Pulses Research Centre Experimental Field, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, Bangladesh during November to March 2004-05 and 2005-06 to study the effects of different insecticides on yield and yield attributes of chickpea. Seeds were preserved with different fungicides and stored them in earthen pots. The seeds were divided into four parts including a part considered as the control. For the insecticide treatment, fungicides such as Sevin, Mipsin and Asataf were used at the rate 1g/kg of chickpea seeds. Chickpea seeds were stored until next planting time and seed quality was observed during storage period. Significant effect of the fungicides was observed on pods/plant both in 2004-05 and 2005-06, seeds/pod in 2004-05 and seed yield both in 2004-05 and 2005-06. The highest values for almost of all these characters were observed when the seeds were preserved with Sevin. Sevin was at par with Mipsin for seed yield of chickpea in 2005-06 only. Among three insecticides, Asataf showed less effect. Sevin treated seeds gave the highest plant height, pods/plant (48.3 in 2004-05 and 48.6 in 2005-06), seeds/pod (1.77 in 2004-05 and 1.81 in 2005-06), 1000-seed weight (120 g in 2004-05 and 121 g in 2005-06) and seed yield (1304 kg/ha in 2004-05 and 1251 kg/ha in 2005-06) which were somewhat identical to Mipsin and Asataf but significantly higher over control.

Keywords: Chickpea, insecticide, storage, yield

Introduction

In storage, chickpea seeds deteriorate their quality due to fungal, insect or other pest infestation. Various insecticides/fungicides are used for protection of seeds. Uses of different chemicals are costly and may cause natural hazard. Comparative studies of insecticides help to choose the suitable one for storing the seeds of chickpea. Damage by the post flowering pests has critical influence on the planting value of mature seeds. Generally attack is initiated in the field and maximum damage occurs during maturity stage after the complete development of seed. Apart from the seed damage in the field, there is also danger of their migration to store along with the seeds resulting in both qualitative and quantitative losses.

Insect infestation affects the germination of the plants (Prakash and Kouraw, 1982; O'dowd and

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Dobie, 1983). It was reported that the infestation of the bruchid on gram (*Cicer arietinum*) was detected and insecticidal treatment given in early stages when the eggs had been laid and grubs were about 5 days old, the germination of seeds might be expected to be as good as in the normal seed.

Use of quality seed is the most essential basic inputs in crop production. Pulse seeds suffer greatly due to insect-pests, rodents, mites and micro-organisms (Narayan *et al*., 1999). Seed store furies a suitable habitat for insects to multiply until food reserves are exhausted which are mostly unable to keep moisture content of seeds at the constant level. Chickpea is highly susceptible to different microorganisms and stored grain pests. Out of these, pulse beetle (*Callosobruchus chinensis* L.) is the most devastating one (Gowda and Kaul, 1982). It is an internal feeder and develops very rapidly in storage. The grubs feed inside the grain causing loss to quality, quantity and viability of seeds.

Poor quality seeds suffer from low levels of germination, seed-borne diseases and contamination, all of which appear to be managerial rather than technological problems. Suitable control measures for pests and diseases, both in the field and during storage may optimize the seed quality. Insecticidal seed treatment is followed in maintaining seed viability in storage. Information regarding aforesaid events is almost scarce in Bangladesh, which are pre-requisite for promotion of chickpea cultivation.

Almost every individual farmer keeps a portion of his produce for quality seed and they are aware of its importance. But, it is not given as much care as it deserves. As a result, seeds kept by the farmer, which have not received due care at the time of its production, preservation and utilization, and do not give satisfactory results in the long run. Most of these seeds are subjected to the inferior quality, infested with pests and diseases, with poor purity and low percentage of germination. This state of affairs had been continuing since long and this is one of the most important reasons of low agricultural production in the country (Ahmed, 1965). A positive correlation between increase in population of storage fungi and loss in germination was obtained.

Controlling of pests during storage is fundamentally important, because any loss in storage cannot be recovered. Losses of pulses both in grain quality and grain weight due to pulse beetle infestation have been assessed by various researchers (Bakr *et al*., 1997; Sharma *et al*., 1986; Sinha *et al*., 1988). Control of storage pests by using synthetic chemicals has become a common practice among the farmers and stockholders. It is now widely known that the chemical method has several problems, which include health hazards to the users and grain consumers. It causes residual toxicity, environmental pollution and development of pesticide resistance. The farmers commonly face the problem of high cost of pesticides and frequent unavailability of effective pesticides. On the other hand, the traditional method of controlling storage pest by sun drying is laborious, time consuming and requires suitable drying yard when large volume of stored grains is involved. Moreover, it depends on favourable weather condition. The study was carried out to determine the effects of three insecticides viz., Sevin, Mipsin and Asataf on the yield and yield attributes of chickpea.

**Materials and Methods**

Field experiments were carried out at the Pulses Research Centre Field, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, Bangladesh. Chickpea (BARI Chola-5) seeds were col-
lected from Pulses Research Centre, BARI, Gazipur during rabi seasons of 2003-04 and kept in earthen pot. Three insecticides viz. Sevin, Mipsin and Asataf were used at the rate 1 g/kg of chickpea seeds and were stored in normal condition. The experimentation field is well drained high land with moderately even topography having irrigation facilities. The area belongs to the Agro-ecological Zone (AEZ 28) under Madhupur Tract. The experimentation site is situated at 24.00° North Latitude and 90.26° East Longitude.

**Preparation of chickpea grains for treatment:**

Clean and fresh chickpea (BARI Chola-5) seeds were taken from the seed lot and sun dried to maintain 9-10% moisture content. Before setting up the experiments, the grains were taken in earthen pots (1 kg size) and placed in a refrigerator at 5°C for seven days to free them from any infesting insect pests. Later, the chickpea grains were stored at room temperature for conducting experiment.

**Experimental procedure:**

The experiment was laid out in a randomized complete block design with six replications and each plot measured 4 m x 3 m. After making lay out of the experiment, the lands were fertilized. Chemical fertilizers at the rate of 24 kg/ha of N as urea, 22 kg/ha of P as triple superphosphate, 28 kg/ha of K as muriate of potash, 15 kg/ha of S as gypsum and 1kg/ha of Zn as zinc sulphate in all the unit plots using Fertilizer Recommendation Guide (BARC, 1997). Full dose of P, K, S, Zn and 1/3 of urea N were applied as basal at final land preparation. The remaining 2/3 of urea N were top-dressed in two equal splits at vegetative stage and at 50% flowering stage followed by irrigation. Weeding was done two times during the whole growth period. Thinning was done on the same date of 1st weeding to maintain plant density. Plant to plant distance was maintained at 10 cm. Ripcord at the rate of 1 ml/litre to control pod borer and fungicide Robral at the rate of 1 ml/L were sprayed two times to control root rot.

**Harvesting:**

The harvest date was determined when the pods became green to brown colour. After harvesting the crop, samples were dried with sunshine for three days and then threshed by beating in the floor. A sample of 10 plants was taken separately from each plot. Prior to storage, seeds were air-dried on a clean polythene sheet spreading over pucca floor of the field laboratory for 3-4 days. During drying, seeds were turned up and down at several times and mixed thoroughly in order to obtain a single uniform composite lot. Then the dried seeds were stored in earthen pot.

**Data collection:**

Among the ten rows of each plot, middle 6 rows were kept for harvesting per plot seed yield. Outer two rows except the border rows from each side were used for sampling of plant height. After harvesting, 10 plants from each plot excluding border lines were selected randomly and tagged by a sample stick to record necessary data. The sample plants were uprooted carefully from the soil. Then the data on yield and yield contributing characters were recorded as follows:
Plant height:
The data on plant height (cm) were recorded by taking 10 randomly selected plants from each plot at different days after sowing (DAS) (i.e. 20 days interval).

Days to 1\textsuperscript{st} flowering, 50\% flowering and maturity:
Days to 1\textsuperscript{st} flowering was counted from the date of sowing to the date of 1\textsuperscript{st} flowered in each plot. Days to 50\% flowering was counted from the date of sowing to the date of 50\% of plants flowered in each plot and days to maturity was counted days required from the date of sowing to maturity of a plant were recorded.

Pods/plant, seeds/pod and 1000-seed weight:
Total number of pods was counted for pods/plant from ten selected plants separately. For seeds/pod, ten pods were selected randomly from the bulk of the pods harvested from ten selected plants and numbers of seeds were counted individually from each of them. For seed weight, 1000-seeds were counted randomly and their dry weight was measured.

Seed yield:
Yield data were collected from 3 m x 1.8 m area of each plot and the yields were converted to kg/ha. Chickpea crops were harvested on 01 March 2005 and 28 February 2006. The harvested seeds were threshed, cleaned, and dried properly. Each seed sample was then divided into three and stored in earthen pot for next growing season.

Statistical analysis:
The data for different characters were compiled and tabulated in proper form and then subjected to statistical analysis following a computer IRRISTAT and MSTAT package programme adjusting the means (Freed, 1992). The correlation co-efficient and regression analysis were done for different variables wherever needed using Microsoft Excel Programme 1997.

Results and Discussion

Plant height
Seeds preserved with different insecticides differed significantly on plant height at 20 DAS in 2004-05 and 60 DAS in 2005-06 (Fig. 1). Plant height increased progressively with the advancement of plant growth stage. The tallest plant height of 48.7 cm in 2004-05 and 49.0 cm in 2005-06 at 100 DAS was recorded by the seeds collected which were preserved with Sevin. The shortest plant height (14.2 cm in 2004-05 and 16.1 cm in 2005-06) was recorded when the seeds preserved in control condition at 20 DAS.
Fig. 1. Effects of different insecticides on plant height of chickpea at different days after sowing during 2004-05 and 2005-06.

Fig. 2. Effects of different insecticides on days to flowering and maturity of chickpea at different days after sowing during 2004-05 and 2005-06.
Days to 1st flowering, 50% flowering and maturity

Days to 1st flowering were found significant only in 2004-05 (Fig. 2). The values were ranged from 65 to 69 days over the insecticides and years. Days to 1st flowering (70 DAS in BARI Chola-5) was observed (Anon., 2005-06). Effect of three insecticides on days to 50% flowering showed non-significant (Fig. 2). Fifty percent flowering ranged from 82 to 84 days over the insecticides and years. Days to maturity were also found to be non-significant (Fig. 2). Days to maturity ranged from 123 to 125 days over the insecticides and years. It was 117 DAS in BARI Chola-5 as observed (Anon., 2005-06) and was ranged from 120-125 in BARI Chola-5 as reported by Bakr et al. (2002).

Pods/plant

Pods/plant differed significantly (Table 1). Significant different regarding pods/plant might be due to higher germination percentage and vigorous growth which ultimately gave higher pods/plant and seedling growth. The highest number of pods/plant (48.3 in 2004-05 and 48.6 in 2005-06) was recorded in Sevin and it was statistically identical to Mipsin and Asataf in 2004-05 and only to Mipsin in 2005-06. The lowest number of pods plant⁻¹ (38.2 in 2004-05 and 38.7 in 2005-06) was found when the seeds stored in control condition.

Table 1. Effects of different insecticides on yield and yield attributes of chickpea

<table>
<thead>
<tr>
<th>Insecticides</th>
<th>Pods/plant 2004-05</th>
<th>Seeds/pod 2004-05</th>
<th>Seeds/pod 2005-06</th>
<th>1000-seed weight (g) 2004-05</th>
<th>1000-seed weight (g) 2005-06</th>
<th>Seed yield (kg/ha) 2004-05</th>
<th>Seed yield (kg/ha) 2005-06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sevin</td>
<td>48.3a</td>
<td>1.77a</td>
<td>1.81a</td>
<td>120a</td>
<td>121a</td>
<td>1304a</td>
<td>1251a</td>
</tr>
<tr>
<td>Mipsin</td>
<td>47.8a</td>
<td>1.77a</td>
<td>1.79a</td>
<td>120a</td>
<td>119ab</td>
<td>1138b</td>
<td>1189a</td>
</tr>
<tr>
<td>Asataf</td>
<td>44.3a</td>
<td>1.73a</td>
<td>1.78a</td>
<td>118ab</td>
<td>117b</td>
<td>1015c</td>
<td>1031b</td>
</tr>
<tr>
<td>Control</td>
<td>38.2b</td>
<td>1.53b</td>
<td>1.50b</td>
<td>117b</td>
<td>116b</td>
<td>847d</td>
<td>869c</td>
</tr>
<tr>
<td>SE (±)</td>
<td>2.02</td>
<td>0.07</td>
<td>0.10</td>
<td>1.07</td>
<td>1.51</td>
<td>32.6</td>
<td>55.92</td>
</tr>
<tr>
<td>Sig.</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>*</td>
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<tr>
<td>LSD (0.05)</td>
<td>4.30</td>
<td>0.22</td>
<td>2.28</td>
<td>3.21</td>
<td>69.5</td>
<td>119.2</td>
<td></td>
</tr>
<tr>
<td>CV (%)</td>
<td>7.8</td>
<td>6.7</td>
<td>10.2</td>
<td>16.0</td>
<td>2.2</td>
<td>5.3</td>
<td>8.9</td>
</tr>
</tbody>
</table>

In a column, having common letters are not differ significantly at 5% level of DMRT

NS: Not significant

Seed/pods

Seeds preserved with insecticides significantly differed for seeds/plant (2005-06) over control in seeds preserved with insecticides Sevin and the result was identical to Mipsin and Asataf. The lowest number of pods was produced by control condition. All the three insecticides performed higher over control condition.

1000-seed weight

Effect of insecticides on 1000-seed weight was significantly differed (Table 1). Preserved seeds with Sevin gave healthy seeds which increased 1000-seed weight. The highest 1000-seed weight (120 g in 2004-05 and 121 g in 2005-06) was obtained by the seeds collected from Sevin and the result was identical to Mipsin only in 2004-05. Thousand seed weight was found to range from 110-120 g in BARI Chola-5 as observed by Bakr et al. (2002).
Seed yield

Seed yield were significantly differed (Table 1). The highest seed yield (1304 kg/ha in 2004-05 and 1251 kg/ha in 2005-06) was recorded when the seeds preserved with Sevin and it was identical to Mip-sin only in 2005-06. This might be due to higher germination percentage, seedlings growth, pods/plant, seeds/pod and 1000-seed weight which ultimately recorded higher yield. The lowest seed yield (847 kg/ha in 2004-05 and 869 kg/ha in 2005-06) was found in control condition in both the years. Seed yield ranged from 1700-2000 kg/ha in BARI Chola-5 was observed by Bakr et al. (2002).

Table 2. Correlation matrix among different parameters of chickpea

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height</td>
<td>0.368</td>
<td>0.415</td>
<td>0.222</td>
<td>0.299</td>
<td>0.457</td>
<td>0.397</td>
</tr>
<tr>
<td>Pods/plant</td>
<td>-</td>
<td>-</td>
<td>0.543**</td>
<td>0.708**</td>
<td>0.700**</td>
<td>0.962**</td>
</tr>
<tr>
<td>Seeds/pod</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.526**</td>
<td>0.699**</td>
</tr>
</tbody>
</table>

* Significant at 5% level, ** Significant at 1% level, NS: Not significant

Correlation

Correlation matrix among the plant characters of chickpea has been shown in Table 2. A positive and significant correlation was observed between plant height and pods/plant, seed yield; pods/plant and seeds/pod, seed yield; seeds/pod and seed yield.

From the result, it was concluded that seed preserved with Sevin had higher pods/plant, seed/pod, and seed yield both in 2004-05 and 2005-06. The overall two years results indicated that all the three insecticides gave better results in most of the parameter studied. Among the three insecticides Sevin performed better for storing of chickpea seed under normal storage condition.

References

Freed, R.D. (1992) MSTAT-C. Crop and Soil Science Department, Michigan State University, USA.