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Demonstration of Apron Star 42 WS Seed Dressing Chemical against Cutworm (*Agrotis segtum*) on Chickpea using Farmer Research Group Approach at Dembia Woreda, North Gondar, Ethiopia

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Abstract

Ethiopia is the largest chickpea growing country in Africa. Most of the chickpea production is used for domestic consumption as well as for substantial export. However, the national average grain yield in Ethiopia has remained extremely low and owing to different biological and physical constraints. Among these, insect pests have special influence on low level of production and productivity. Cutworm (Agrotis spp.) is one of the important pests of chickpea during seedling stage in Ethiopia and feed on the roots during the day and at night move up to the soil surface and attack seedlings. The trial was conducted in farmer's field with supplementary irrigation at Guramba Michael locality of Dembia district since 2010 to evaluate and determine the efficacy of Apron Star 42 WS seed dressing chemical against cutworm during seedling stage of the crop. The research was followed Farmer Research Group approach to evaluate the intervention based on evaluation criteria of farmers. The experiment was initiated with two treatments such as seeds treated with Apron star 42 WS and seeds not treated with Apron Star 42 WS used as control. Arerti improved chickpea variety was used for each treatment and tested by using simple paired comparison design. Plot size was 10 m × 10 m use. Plot received seeds treated with Apron Star chemical showed early seedlings emergence, vigorous growth, deep green leaves and stout stem with large number of branches as well as large number of seedlings 15 days after emerged (28 per meter square) and least number of damaged plants by cutworm (3 per meter square). However, Plot received seeds not treated with Apron Star chemical showed late seedlings emergence, slow growth, yellowish leaves and week stem with less number of branches as well as least number of seedlings 15 days after emerged (17 per meter square) and large number of damaged plants by cutworm (10 per

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meter square). Both treatments were not shown significant differences in the case of stand counting at emergence and number of plants attacked by wilt root rot disease. Most members of the Farmer Research Group indicated that the improved variety, the seed dressing chemical and the research approach used for evaluation of the intervention were very attractive and useful for chickpea growers where the cutworm is the major bottleneck. Therefore, using seeds treated with Apron star 42 WS seed dressing chemical was effective for the control of cutworm as well as suitable for practicing early sowing time of chickpea to get enough yields.

Keywords

Cutworm, Chickpea, Apron Star, Farmer Research Group, Demonstration

1. Introduction

Ethiopia is the largest chickpea growing country in Africa, with a share of about 37% in area and 48% in production. During 2003/2004, Ethiopia produced 195,800 tons of chickpea from an area of 176,554 ha [1].

Most of the chickpea production is used for domestic consumption. However, there has been a substantial export of chickpea by Ethiopia during the past five years, with the highest of 48,549 t (valued at US$14.7 million) during 2002 [1]. The crop is widely grown in over 24 districts of the country that contain deep black soils and is highly preferred by cash-constrained farmers who cannot afford to buy commercial fertilizers for cereals that are rotated with chickpeas. The major growing areas in the country include Eastern Showa, Western Showa, Gondar, Gojjam and Welo. This makes the crop highly integrated into the farming system and highly ecologically friendly for growing in many areas that suffer from soil nutrient depletion. However, the national average grain yield in Ethiopia has remained extremely low 0.6 - 0.8 t/ha and owing to different biological and physical constraints [2].

The major constraints attached with chickpea production are inherently low grain-yielding potentials of indigenous/local chickpea cultivars including susceptibility to biotic and a biotic stresses. Poor crop management and cultural practices followed by growers. Among these above mentioned factors, insect pests have special influence on low level of production and productivity. Pod borer and cutworm are common insect pests on chickpea in East Africa and India [3]. Five species of Agrotis are known in Ethiopia, these are *A. ipsilon* (Hufn), *A. segtum* (Schiff) and *A. spinifera* (Hbn.). *A. segtum* and *A. ipsilon* are the commonest cutworm in South and Northern Ethiopia respectively [4]. *Agrotis* spps. are important pests of many crops during establishment in Ethiopia [5]. They feed on the roots during the day and at night move up to the soil surface and attack seedlings. The mature larva is 3 - 4 cm long and pupates in the soil. The pupa is about 2 cm long, smooth, and shiny brown, it has two spines at the tip of the abdomen [6]. Mostly lately sown crops are exposed to cutworm damage. Larvae live in the soil and emerge nightly to feed on plant material above ground [7]. The small caterpillars eat portion of the leaves and stems but larger larvae may chew through the stems, often falling the plant at ground level and killing the plants. The damage is severe because the stem is succulent when the incidence is at peak level. However, farmers adopted late planting because of escaping from water logging, physiological wilting and the occurrence of Fusarium wilt-root complex problems. Late planting leads to scarcity of water during grain filling stage of the crop via decreases the quality of seed (Shriveled seed). Therefore, Apron Star has dual purpose for preventing wilt-root complex disease as well as controlling cutworm, because by nature, Apron Star 42 WS has both fungicidal and insecticidal properties. This chemical also important to avoid the shortage of moisture occurring during late stage (flowering up to maturity) of the crop *i.e.* it promotes early planting of chickpea as well as reducing moisture stress, diseases and cutworm problems. The present study, therefore intended to determine the efficacy of Apron Star 42 WS against cutworm.

2. Materials and Methods

2.1. Experimental Materials and Research Procedures

The study was conducted in Dembia district at Guramba Michael locality, North Gondar zone where cutworm is the major constraint of chickpea growers since 2010 by using irrigation. The site was selected by participating

and consulting Dembia District Agricultural and Rural Development Office's experts who are concerned on field crop production. The research was conducted in farmer's field by using irrigation. The first activity done before implementing the research was establishing the Farmer Research Group with the help of Development Agents of the locality. The Farmer Research Group has 25 farmers, out of these 20 males and 5 females. Three farmers were selected to assist the Farmer Research Group as leader, meeting coordinator and secretary. Members of Farmer Research Group was selected based on voluntariness, active participants in crop production (Model farmers); farmers have a lot of experience on chickpea production and protection as well as by considering the criterions raised by Development Agents of the locality.

Two treatments were used for this experiment such as Seeds treated with Apron Star 42 WS seed dressing chemical and seeds not treated with Apron Star 42 WS seed dressing chemical (control) and arranged by simple paired comparison. Arerti chick pea improved variety was used for this research and the variety was collected from Debre Zeit Agricultural Research Center. The rate of chemical applied for seed treatment was 3.75 grams based on the recommended rate of 250 grams per 100 kilograms of seeds. The amount of seed was 1.5 kilograms for each treatment based on the recommended rate of 150 kilograms per hectare. Plot size of 10 m × 10 m was used for each treatment and plots were 2 meters apart from each other. Three times weeding were carried out. Application of water through irrigation was done based on the environment, stages of the crop and soil type. Seeds were treated with Apron Star 42 WS seed dressing chemical by using plastic bag. Seeds mixed with the chemical in plastic bag and shacked vigorously for 10 minutes by applying small amount of water until well the seeds treated or dressed with the chemical and dried the treated seeds for short period by using sun radiation to enhance the attachment of the seeds with chemical as well as to prolong the shelf life of the treated seeds. Seeds were sown two days after treated with chemical. Both treated and untreated seeds were sown in well prepared and moisten land by using broad casting method of sowing at the same time. The Farmer Research Group's members participated actively during site selection, land preparation, seed treatment, sowing time, at emergency of the seedlings, at vegetative stages of the crop and data collection. Every 15 days, The Farmer Research Group's members were meet together for monitoring, evaluation, and discussing about the agronomic and protection aspects of the treated and untreated treatments. The farmers carried out the research work under the guidance of researchers.

2.2. Data Collection

Stand counting at emergence, Stand counting at 15 days after emerged, Number of plants damaged by cutworm per plot and counting of wilted/dried plants per plot were collected by using 1 m × 1 m (1 square meter) sized quadrant. Data of all above mentioned parameters were collected by means of throwing the quadrant randomly in the field. Different Samples taken by walking in zigzag direction and counted the sampled areas of the plot. Diseased plants counted every 15 days after seedlings emerged for three times and the counted diseased plants discarded from the plot. Farmer perceptions and feedbacks about the overall activities of the research were collected

2.3. Germination Test

Germination boll, sand and water were used to test the germination capacity of seeds treated with Apron Star 42 WS and seeds not treated with Apron Star 42 WS (control) of the same variety, Arerti, with the help of North Gondar Zone Seed Laboratory Office. Every three days, both treatments were observed until most of the seeds germinated.

2.4. Stakeholders Participated and Their Roles

Gondar Agricultural Research Center was participated during selection of improved chickpea variety which is suitable and adapted for Dembia district and gave technical advice about Farmer Research Group based research.

Debre Zeit Agricultural Research Centre is collaborated by provided Arerti improved chickpea variety as well as gave manuals which are focused on chickpea crop production and protection.

North Gondar Zone Seed Laboratory Office gave technical support to test the germination capacity of the Apron star 42 WS chemical treated seed and untreated seeds of Arerti improved chickpea variety.

Dembia District Agricultural and Rural Development Office participated actively and played a great role for the successes of the research by undertaken the following activities:

- Site selection (by considering hot spot areas of cutworm)
- Variety selection
- Recruiting Farmer Research Group members
- Assigning leaders and coordinators of the Farmer Research Group members
- Developing rules and regulations for administration of the Farmer Research Group
- Coordinating and facilitating land preparation and irrigation access
- Facilitating capacity building activities and field visit

3. Results and Discussions

3.1. Field Experiment

Evaluation of results found in this research was considered by observing and comparing the two treatments in perspective of agronomic and crop protection features. Seeds treated with Apron Star 42 WS seed dressing chemical showed seedlings with features such as early emergence, vigorous growth, very deep green leaves, short and stout stem and large number of branches originated from the main stem. There was no significance difference on number of seedlings/stand count/ at emergence between two treatments. However, large number of seedlings (28 per m^2) 15 days after emerged as well as least number of seedlings damaged/infested/ by cutworm (3 per m^2)and attacked by Fusarium wilt-root rot complex disease (2 per m^2) recorded from plot sown with seeds treated with Apron Star 42 WS seed dressing chemical "**Table 1**". Plot sown with seeds not treated with Apron Star 42 WS seed dressing chemical showed seedlings with features such as a little bit late emergency, slower growth, yellowish leaves, little bit long and delicate stem and small (weak) number of branches originated from the main stem. Least number of seedlings 15 days after emerged (17 per m^2), large number of seedlings damaged/infested/by cutworm (10 per m^2), a little bit more(no significance difference) number of plants attacked by Fusarium wilt-root rot complex disease (4 per m^2) was recorded from control as compared to the treated one "**Table 1**". No significance difference between two treatments in the case of disease damage or attack because of the nature of the research *i.e.* it was carried out by irrigation and there was no excess moisture which is aggravated Fusarium wilt-root disease especially common in main season of chickpea cultivation. All the above mentioned research findings evaluated by Farmer Research Group together with researchers.

3.2. Laboratory Results

Based on the activities carried out in the seed laboratory, both treated (Apron Star 42 WS) and untreated seeds (control) showed 85% and 87% seed germination respectively as well as 7 and 6 days taken to germinate all seeds after inserted into moisten sand respectively. The economic aspect of the chemical was not conducted in this experiment due to the nature of the study *i.e.* it was only focused on vegetative stages of the crop. Therefore, it is difficult to analyze the economical feasibility of the Apron Star 42 WS seed dressing chemicals.

3.3. Farmers' Perception and Evaluations

Most farmers appreciated the research approaches followed as well as they are actively participated from site selection up to the end of evaluation of the research. Majority of members of the Farmer Research Group indi-

Table 1. Comparison of results obtained from the treated and untreated treatments.

Treatments	Average number of plants counted at emergence per m^2	Average number of plants counted after emerged per m^2	Average number of plants damaged by cutworm per m^2	Average number of plants Attacked by wilt-root rot disease per m^2
Seeds treated with Apron Star 42 WS	**33**	**28**	**3**	**2**
Seeds not treated with Apron Star 42 WS (control)	**31**	**17**	**10**	**4**

cated that the improved variety (Arerti), the seed dressing chemicals (Apron Star 42 WS) and techniques used for conducting and evaluating the research were very attractive and useful for chickpea growers especially where the cutworm and Fusarium wilt-root rot complex disease are major bottleneck for chickpea production. Most members of the Farmer Research Group commented that this research should be repeated in the main growing season of chickpea because most chickpea growers using residual soil moisture especially at the last days of August to the first 15 days of September to cultivate chickpea and this time of sowing is perceived as important to avoid problems related with germination due to high moisture and wilt-root rot complex disease. However, the major problems in related with farmers sowing time are the moisture stress during flowering and grain filling stages of the crop. Therefore, farmers are appreciated this seed dressing chemicals for alleviating moisture stress occurring during flowering and grain filling stages of the crops by sowing seeds dressed with Apron Star 42 WS at the first days of August with using water drainage techniques like Broad Bed Making (BBM) farm implements or using different type of tillage which are important for draining of excess moisture from chickpea field. Suggestion forwarded by majority of the Farmer Research Group's members indicated that this type of research approach and technologies should be undertaken for other crops like fenugreek and grass pea.

4. Conclusion and Recommendation

Our present data are not yet conclusive and since there is little information on this important insect pest and its management method as well as research approach. There is a need to investigate further management methods and approaches. However, based on the overall results of experiment, the criterion used for evaluation of the research conducted by the members of Farmer Research Group and their findings indicated that chickpea seeds treated with Apron Star 42 WS seed dressing chemical showed better performance against cut worm as compared to the untreated one at early stage of the crop. Thus, it can be safely recommended as protection method against cutworm for chickpea growing areas of the study site and around it in the district as well as promoting early sowing time to reducing moisture stress occurring during late stages of the crop.

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