

During the survey, the species of pod borer could not be determined. In the chickpea experiments on pod borer infestation during this season in southern Syria only *H. viriplaca* was noticed, whereas in previous seasons it occurred together with *H. armigera*.

The survey data show that in years with favorable climatic conditions for the pest, the pod borers do cause extensive damage to chickpea in southern Syria. Therefore, experiments are being conducted in that area on the life cycle of the pest, the effect of sowing dates, and plant density on pest population, and the economic threshold, so that an integrated control schedule could be developed.

Improving Pesticide Dust Application in Chickpea

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Though spraying is preferred to dusting in pesticide application, many dryland crops in India like chickpea, safflower, groundnut, pigeonpeas, etc., are often dusted. Application of pesticidal dust with bare hands is a common practice in many areas, though such applications are hazardous to the person. The use of commonly available dusting machines like a hand-rotary and motorized knapsack dusters is rare. This may be because of farmers' apprehension that these machines do not have much advantage over hand-dusting. The study of the operation of these machines reveal the following problems.

- A. These machines release dust in front of the operator. As a result, the operator has to normally walk through a dust cloud produced continuously in front of him. This is not only suffocating but also hazardous to the operator.
- B. The operator needs to bend to the level of crop bearing the mass of the duster. This causes much inconvenience to the operator.

To solve these problems, efforts have been made at ICRISAT to improve dusting application with the available machines.

1. Hand-rotary dusters

Two types of hand-rotary dusters are available in the Indian market; the oldest one is a shoulder-carried duster and the preferred new one is a 'Chest-carried

duster' (Fig. 1). A simple modification in the design of the chest-carried duster was tried at ICRISAT Center (Fig. 2). The blower of the duster was turned 90° anticlockwise to channelize dust onto the left, and behind the operator with 1-m long PVC pipe. A plastic deflector was attached to the end of the PVC pipe to direct dust well into the crop. The height of the release of dust was adjusted with an adjusting clamp on the blower box. In a preliminary trial on chickpea the improved duster

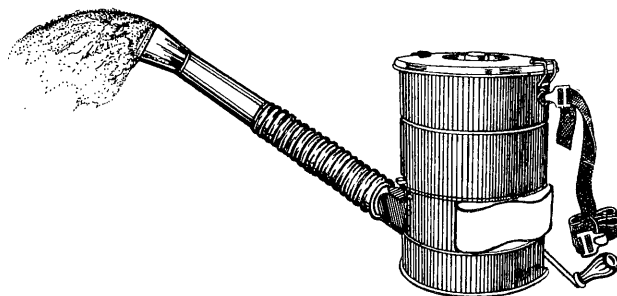


Figure 1. Chest carried hand rotary duster.

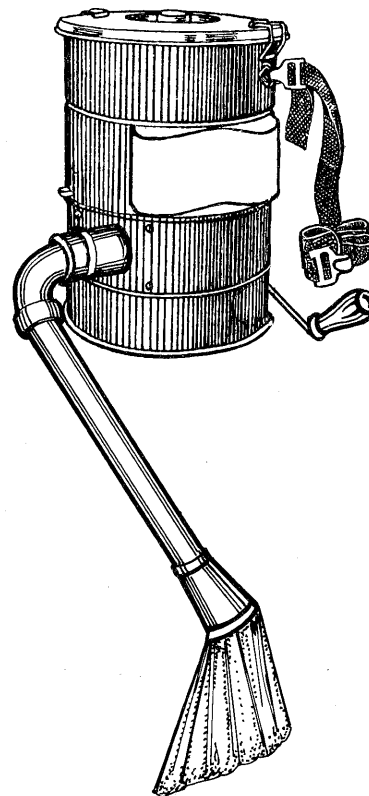


Figure 2. Chest carried hand rotary duster after improvement.

deposited 64% of the applied pesticide on the crop as against 55% deposited by the original duster. Besides 9% increase in deposition of dust on the crop, far greater convenience was experienced by the operator in pesticide application with the improved duster.

2. Motorized knapsack

A motorized knapsack can also be used for dusting (Fig. 3) although spraying is most commonly practiced with it. Two simple modifications were tried to improve pesticide application.

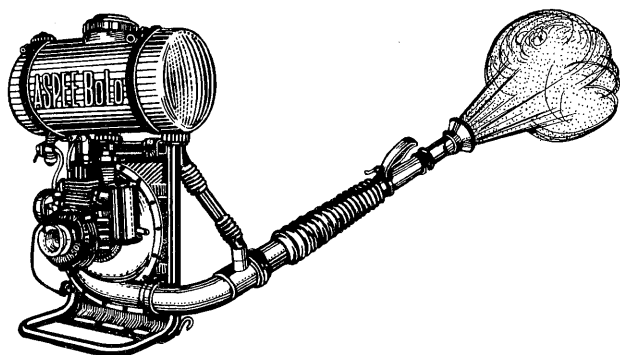


Figure 3. Mist blower cum duster.

- a. Using a deflector on delivery hose: A plastic deflector available in the market with a hand-held rotary duster was used attached to the delivery hose of the motorized knapsack (Fig. 4) to direct dust well onto the crop rather than releasing it as normal on the crop. This simple idea tried in chickpea helped to deposit 60% of the applied pesticide on the crop as against 51% by the original motorized knapsack. Pesticidal deposit was improved along with more convenience in pesticide application.
- b. Using a long perforated polythene pipe on delivery hose: The use of a 9.14-m long perforated polythene pipe attached to a motorized knapsack to direct dust into the crop was first tried by one Japanese farmer during 1960s, and now it is a most common practice for dust application in rice in Japan. During 1970s some Indian pesticide-appliances manufacturing companies tried to introduce this system in India with their motorized knapsack to dust the cotton crop. However, this did not work well on cotton which is wide spaced and grows tall. ICRISAT tried this idea in 1980s to

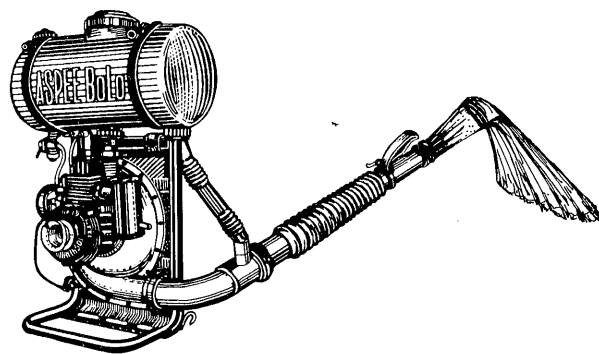


Figure 4. Motorized knapsack with deflector.

dust chickpeas with an Indian motorized knapsack (Fig. 5), which has an operational rpm of 3500-4000 for its blower fan. A 6.09-m long polythene pipe having 12 mm (diameter) holes after every 25.4 cm in one line on the lower side of the pipe was used. This pipe is attached to the motorized knapsack mounted on the back and the other end is held by another person, who also walks at a distance with the same speed while carrying the tube over the crop. It took about 45 min to cover a hectare of crop. The application was very convenient for the operators. However, there were some problems in free flow of dust largely because of low rpm of the motorized knapsack. We therefore, suggest that the speed of the blower fan of the motorized-knapsack sprayers should be on par with that of a Japanese motorized knapsack sprayer. The quality of the polythene pipe should also be improved.

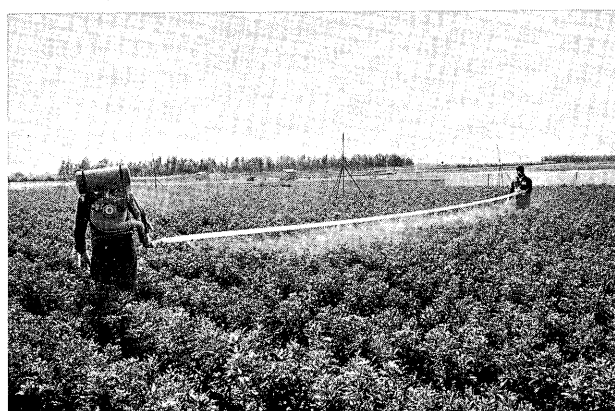


Figure 5. Motorized knapsack with wide dusting attachment.

Unlike in Japan, only one type of formulation of dust is produced in India with a specification that 90% of it passes through 200-mesh sieve; i.e., the particle size of 75 μ has been specified. Further, the dust formulation is not always made with a free-flowing powder like calcium silicate or talc, but also with a clay, which often forms lumps. In Japan, as many as seven types of dust formulations with more fine particles (44 μ) are produced and used. This aspect also needs to be studied for further improvement in dust application.

Pathology

Field Screening of Chickpea for Resistance to Wilt/Root Rots in Ethiopia

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Chickpea (*Cicer arietinum* L.) is an important pulse crop occupying about 15% of the total cropped area of pulse crops cultivated in the highlands of Ethiopia (FAO 1987). The productivity of the crop is only 0.66 t ha⁻¹ which is much lower than many other chickpea-producing countries in the world (FAO 1987; Million Eshete and Beniwal 1988). Of the several stress factors responsible for this low productivity, diseases are considered as an important stress factor (Alemu Mengitsu 1978; Habtu Aseffa and Dereje Gorfu 1986). Among the diseases affecting chickpea in Ethiopia, wilt (*Fusarium oxysporum* f. sp. *ciceri*), dry root rot (*Rhizoctonia bataticola*) and stunt (bean leaf roll virus) are economically important, whereas wet root rot (*R. solani*), collar rot (*Sclerotium rolfsii*), and ascochyta blight (*Ascochyta rabiei*) are of minor importance (Habu Aseffa and Dereje Gorfu 1986).

Considering the importance of wilt and root rots, and the subsistence chickpea cultivation in Ethiopia, research priority was to develop varieties resistant to these diseases. To achieve this objective, research efforts were initiated at Debre Zeit

Agricultural Research Center (DZARC) from the 1986/87 cropping season to develop a wilt-sick plot to embark upon the resistance-screening work for these diseases. In this paper, we report the results of our efforts on these aspects.

Chickpea field (0.1 ha) at DZARC with a history of wilt/root rots incidence was chosen in 1986 for its development into a wilt/root rots sick plot. The technique developed at ICRISAT was adopted for the development of a sick plot (Nene et al. 1981). A wilt-susceptible JG 62, obtained from ICRISAT was sown in the plot in the 1986/87 main crop season (Aug 1986 to Jan 1987) and in the 1987 off-season (Mar to May 1987). Dead plants in both the crop seasons were incorporated into the soil. The plot was used for screening chickpea in the 1987/88 season.

For disease screening, two test entries were alternately sown with the susceptible control to monitor the uniformity and efficiency of the disease screening. Each test entry and the susceptible control was sown in one 4-m row, 30 cm apart. A total of 211 wilt/root rot promising chickpea lines received from ICRISAT were sown in the 1st week of September. Observations on wilt/root rots incidence were recorded at 15-day-intervals from emergence of chickpea seedlings to their maturity. In 1988/89 main cropping season, 48 chickpea lines/varieties that showed less than 20% mortality because of wilt/root rots in the 1987/88 main cropping season were sown and evaluated.

The susceptible control, JG 62, showed 50% mortality because of wilt/root rots right in the 1986/87 main crop season which was increased to 80% in the 1987 off-season. It showed an average of 95% mortality during the 1987/88 and 1988/89 main cropping seasons (Table 1) indicating a uniformity of inoculum in the sick plot. The results of the isolations from the dead plants onto potato-dextrose-agar showed that the mortality was mostly caused because of wilt and dry root rot and very little because of wet root rot and collar rot. The seedling mortality from flowering onwards was mainly because of wilt. At the podding stage, mortality was mainly because of dry root rot.

All the test entries were affected with wilt/root rots although they varied considerably in their reactions (Table 1). Of the 211 entries tested, 48 showed less than 20% mortality in the 1987/88 cropping season. During the 1988/89 season also all the 48 entries except two (ICC 14399 and ICCL 85108) showed less than 20% mortality (Table 1).

Based on mean percent mortality and desirable agronomic traits (early maturity, uniformity, and good podding), 22 lines were selected in the 1988/89 season for their initial yield evaluation