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### Original article

## On-farm demonstration of fungicide for the control of chocolate spot (*Botrytis fabae* L.) on faba bean in Bale zone, Ethiopia

Ermias Teshome<sup>a,\*</sup>, Dagne Kora<sup>b</sup>, Amare Biftu<sup>c</sup>, Ayalew Sida<sup>c</sup>

<sup>a</sup>Oromia Agricultural Research Institute (OARI), Pulse Crops Pathologist, Sinana Agricultural Research Center P.O. Box-208, Bale-Robe, Ethiopia.

<sup>b</sup>Oromia Agricultural Research Institute (OARI), Pulse Crops Entomologist, Sinana Agricultural Research Center P.O. Box-208, Bale-Robe, Ethiopia.

<sup>c</sup>Oromia Agricultural Research Institute (OARI), Agricultural Research-Extensionist, Sinana Agricultural Research Center P.O. Box-208, Bale-Robe, Ethiopia.

\*Corresponding author: [ermiastafa@gmail.com](mailto:ermiastafa@gmail.com)

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#### ABSTRACT

Faba bean (*Vicia faba* L.) is one of the most important food legumes in the world and in Bale-highlands as well. The experiment was executed for one year at Goba and Dinsho districts with the objectives of demonstrating different fungicide for the control of chocolate spot on faba bean and to give awareness on the use and effectiveness of the fungicide against chocolate spot on faba bean. The experiment was conducted using one faba bean varieties; Moti and two fungicide Mancozeb 80% (2.5 kg/ha) and Odeon 825 WG (2.5 kg/ha). The highest mean chocolate spot severity index recorded was 55% on unsprayed plot and the minimum mean chocolate spot severity index was recorded on Odeon 825 WG sprayed plot 27.5% severity at Goba district. Mancozeb 80% WP sprayed plots gave higher yield 2680 kg/ha and 2490 kg/ha at both locations as compared to Odeon 825 WG and unsprayed plots. Maximum percent of seed yield was increased over check by Mancozeb 80% WP 34.33% at Goba. Mancozeb 80% WP sprayed plot provided the highest gross returns (birr 40,200/ha) and 37,350/ha at Goba and Dinsho, respectively. The lowest gross return was computed from untreated check at both locations. The plot sprayed with Mancozeb 80% WP gave the maximum net return and also gave the highest benefit cost ratio at

both locations. Farmers and others stakeholders can use these fungicides by integrating with other option to maximize their production and productivity as well as quality.

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## 1. Introduction

Faba bean (*Vicia faba* L.) is one of the earliest domesticated food legumes in the world, probably in the late Neolithic period (Metayer, 2004). It is used as human food in developing and as an animal feed in developed countries. Food value of faba bean is high and this legume has been considered as a substitute of meat due to its high protein content (24-41 %) and provides the much needed protein supplement to the diet of rural households (Crépona et al., 2010).

From the economic point of view, faba bean is a source of cash to the farmers and foreign currency to the country. Now days as Ethiopian farmers are getting aware of the role of legumes in general and faba bean in particular in improving soil fertility by fixing atmospheric nitrogen and soil health as well; they are widely using Faba bean in rotation with cereals (Sahile et al., 2008a). The crop occupies the largest area in Ethiopia among other pulses and currently the total area under cultivation is increasing dramatically, which is estimated to be about 521,000 ha from which 6,886,670 quintals are produced (MoARD, 2008).

The crop is grown in several regions of the country receiving annual rainfall of 700-1000 mm (ICARDA, 2006). Despite the availability of high yielding varieties in Ethiopia, the average yield of faba bean under small-holder farmers is not more than 1.8 t ha<sup>-1</sup> (CSA, 2014; MoA, 2011). This low productivity is attributed to its susceptibility to biotic stresses mainly diseases (Sahile et al., 2008a; Mussa et al., 2008; Nigussie et al., 2008; Berhanu et al., 2003). The most important yield limiting diseases are chocolate spot (*Botrytis fabae*), rust (*Uromyces vicia-fabae*), black root rot (*Fusarium solani*) and Aschochyta blight (*Aschochyta fabae*) (Mussa et al., 2008; Ahmed et al., 2010). Different Experiments have conducted so far on the management of Chocolate spot. According to a survey conducted, this disease was prevalent in all the faba bean growing areas. In spite of wide cultivation of faba bean and widespread occurrence of chocolate spot, research efforts were concentrated on fungicide applications. But our farmers have limited information on the use of fungicide for pulse crops. So to alleviate such limitation the activity was initiated with the following objectives:

- ✓ To demonstrate different fungicide for the control of chocolate spot on faba bean.
- ✓ To give awareness on the use and effectiveness of the fungicide against chocolate spot on faba bean.

## 2. Materials and methods

### 2.1. Description of study areas

The experiment was done on the farmer's field at one location Goba and Dinsho districts during 2017 - 2018 cropping seasons. The location is suitable for appearance of chocolate spot every year under natural conditions. Goba located at 1517 - 4378 meters above sea level receiving mean annual rainfall of 937.3 - 1342.44 mm and mean annual temperature of 6.53-1958 °C. Dinsho located at 2444 - 4250 meters above sea level receiving mean annual rainfall of 965.03 - 1314 mm and mean annual temperature of 7.07-15.33 °C (Adamu Zeleke unpublished survey). Soil type is Pellic Vertisol and Vertisols for Goba and Dinsho, respectively.

### 2.2. Treatments and experimental design

The experiment was conducted using one faba bean varieties; Moti. Two fungicides Mancozeb 80%WP (2.5 kg/ha) and Odeon 825 WG (2.5 kg/ha) were used in the experiments with two frequencies at 8 day intervals. The experiment was laid out in none replicated with three plots.

- ✓ Plot one Mancozeb 80% WP sprayed plot.
- ✓ Plot two Odeon 825 WG sprayed plot.
- ✓ Control (unsprayed).

The plots have a size of 25 m<sup>2</sup> (5m x 5m). Normal agronomic practices were followed after the emergence of the crop. The fungicide application was started after the appearances of the diseases.

### 2.3. Data collections and analysis

Chocolate spot severity was assessed per plot wise at a weekly interval from the time disease first appeared until the crop attained its physiological maturity. The average severity from the taken per plot was used for analysis. Disease severity on leaves was rated using 1-9 rating scale (Bernier et al., 1993), where 1= no disease symptoms or very small specks; 3= few small discrete lesions; 5= some coalesced lesions with some defoliation; 7= large coalesced sporulating lesions, 50% defoliation and some dead plant; and 9= extensive lesions on leaves, stems and pods, severe defoliation, heavy sporulation, stem girdling, blackening and death of more than 80% of plants and according to Bernier et al. (1984), the disease severity scores was converted in to Percentage severity index (PSI) for analysis using the following formula.

$$PSI = \frac{Snr}{Nps \times Msc} \times 100$$

Where

Snr = Sum of numerical ratings

Nps = Number plants scored

Msc = Maximum score on the scale

Yield losses will be calculated separately for each of the treatments with different levels of disease, as:

$$RL (\%) = \frac{(Y1 - Y2)}{Y1} \times 100$$

Where, RL% = Percentage of relative loss (reduction of the parameters; i.e. yield, yield component),

Y1 = mean of the respective parameter on protected plots (plots with maximum protection)

Y2 = mean of the respective parameter in unprotected plots (i.e. unsprayed plots or sprayed plots with varying level of disease).

### 2.4. Farmers' selections and evaluations

Farmers were participated on the evaluations of fungicide against faba bean chocolate spot. Selection and evaluations was considered on the farmers' interests and motivation toward the technology.

## 3. Results and discussion

The highest mean chocolate spot severity index recorded was 55% on unsprayed plot at Goba district. The minimum mean chocolate spot severity index was recorded on Odeon 825 WG sprayed plot 27.5% severity (Table 1). At Dinsho mean chocolate spot severity index before spray and after spray was equal this was due to the fungicide stop the severity progress even after fungicide spray application (Table 1). The mean chocolate spot severity index was higher at Goba as compared to Dinsho. In addition to chocolate spot severity there were high severities of rust and ascochyta blight at both locations, especially at flowering stage of faba bean.

The fungicide reduced the mean chocolate spot severity index by 50% as compared to unsprayed plots. But overall, the mean severity of chocolate spot was lower during the 2017/2018 cropping season as compared to previous cropping seasons.

The Mancozeb 80% WP sprayed plots gave higher yield 2680 kg/ha and 2490 kg/ha at both locations. The unsprayed plots gave the minimum yields at both locations 1650 kg/ha and 1760 kg/ha. Maximum percent of seed yield was increased over check by Mancozeb 80% WP 34.33% at Goba. The plot sprayed by Odeon 825 WG was increased the yield over check by 20.36% and 22.17% at Goba and Dinsho, respectively. Mancozeb 80% WP sprayed plot at Dinsho increased the yield over check by 33.74 percent (Table 2).

Generally the yield obtained was lower as compared to the production potential of faba bean obtained by research findings even lower than the yield obtained at the farmer's level. On average the faba bean yield obtained at research level was more than 50 ton per hectare and at farmers level more than 38 ton/ha. The reason for the

lower yield obtained were:- High rain fall occurred in the cropping season can lodge the faba bean, the crop setting less number of pod per plants in the cropping season and also setting less number of tillering, these reasons can contribute for the lower yield in the cropping seasons.

**Table 1**

Average chocolate spot severity index at Goba and Dinsho districts in 2017 cropping season.

| Districts | Treatments      | Rust   |       | C. Spot |       | A. Blight |       |
|-----------|-----------------|--------|-------|---------|-------|-----------|-------|
|           |                 | Before | After | Before  | After | Before    | After |
| Goba      | Odeon 825 WG    | 11     | 11    | 33      | 27.5  | 11        | 16.5  |
|           | Mancozeb 80% WP | 11     | 16.2  | 38.5    | 33    | 11        | 16.5  |
|           | Control         | 11     | 22    | 38.5    | 55    | 11        | 27.5  |
| Dinsho    | Odeon 825 WG    | 11     | 11    | 33      | 33    | 11        | 22    |
|           | Mancozeb 80% WP | 11     | 11    | 22      | 22    | 11        | 22    |
|           | Control         | 11     | 22    | 22      | 33    | 11        | 22    |

**Table 2**

Average grain yield of faba bean obtained at Goba and Dinsho.

| Districts | Treatments            | Grain yield | Percent yield        |
|-----------|-----------------------|-------------|----------------------|
|           |                       | Kg/ha       | increased over check |
| Goba      | Mancozeb 80% WP       | 2680        | +34.33               |
|           | Odeon 825 WG          | 2210        | +20.36               |
|           | Control (not sprayed) | 1760        |                      |
| Dinsho    | Mancozeb 80% WP       | 2490        | +33.74               |
|           | Odeon 825 WG          | 2120        | +22.17               |
|           | Control (not sprayed) | 1650        |                      |

### 3.1. Return and benefit cost ratio

Mancozeb 80% WP sprayed plot provided the highest gross returns (ETB 40,200/ha) and 37,350/ha at Goba and Dinsho, respectively. The lowest gross return was computed from untreated check at both locations (Table 3). The plot sprayed with Mancozeb 80% WP gave the maximum net return ETB 21506/ha and also gave the highest benefit cost ratio 1.15 at Goba. The unsprayed plot gave the minimum net returns ETB 9882.00/ha and gave the benefit cost ratio (0.6) at Goba. The Mancozeb 80% WP sprayed plot provided the highest gross returns (ETB 37,350/ha) and the lowest gross return (ETB 24,750/ha) was computed from untreated check (Table 3) at Dinsho. The plot sprayed with Mancozeb 80% WP gave the maximum net return ETB 18,713/ha and also gave the highest benefit cost ratio (1.00) as compared to Odeon 825 at Dinsho. The unsprayed plot gave the minimum net returns ETB 8,265/ha and gave the benefit cost ratio (0.5).

**Table 3**

Return and benefit cost ratio of treatment for the control of chocolate spot on faba bean during 2017/18 cropping season at Goba and Dinsho districts.

| Districts | Treatment          | Yield obtained (Kg/ha) | Sale price (ETB/qt) | Total                       | Gross                   | Net Return (GR-TVC) | Benefit cost ratio (NR/TVC) |
|-----------|--------------------|------------------------|---------------------|-----------------------------|-------------------------|---------------------|-----------------------------|
|           |                    |                        |                     | Variable Costs TVC (ETB/ha) | Returns (Price X Qt) TR |                     |                             |
| Goba      | Mancozeb 80% WP    | 2680                   | 1500                | 18,694                      | 40200                   | 21506               | 1.15                        |
|           | Odeon 825 WG       | 2210                   | 1500                | 17,553                      | 33150                   | 15597               | 0.89                        |
|           | Control (no spray) | 1760                   | 1500                | 16518                       | 26,400                  | 9,882               | 0.60                        |
| Dinsho    | Mancozeb 80% WP    | 24.9                   | 1500                | 18,637                      | 37350                   | 18713               | 1.00                        |
|           | Odeon 825 WG       | 21.2                   | 1500                | 17,526                      | 31800                   | 14274               | 0.82                        |
|           | Control (no spray) | 16.5                   | 1500                | 16485                       | 24,750                  | 8,265               | 0.50                        |

### 3.2. Farmers' perceptions

About 50 farmers were participated on the evaluation and selection of insecticides at Goba and 42 farmers were participated at Dinsho. At both locations the farmers were selected the plot sprayed by Mancozeb 80% WP and Odeon 825 WG as their first choice. During the evaluation and selections farmers mostly considers the burned stem, leaf of the crop. Accordingly they said that the plot with no fungicide applications was more damaged by the disease as compared to the untreated plot. To avoid the biasness during evaluation and selection farmers haven't get any clue on the sprayed and unsprayed plot. They simply observe the status of the plots only.

### 4. Conclusion

The result obtained from the two districts indicated that the fungicides (Mancozeb 80% WP and Odeon 825 WG) are remained the most effective against the chocolate spot on faba bean. The net benefits from fungicides (Mancozeb 80% WP and Odeon 825 WG) sprayed plot was higher than those for unsprayed plot.

Both fungicides were the most effective fungicide for the effective management of chocolate spot on faba bean. Hence, it is recommended that farmers should have to use both fungicides for the control of chocolate spot on faba bean. Farmers can use one chemical in the absence of the others as alternatives to control this disease.

Therefore, farmers and others stakeholders can use these fungicides by integrating with other option to maximize the production and productivity as well as quality. It is better to scale up/out the above fungicides for the control of chocolate spot on faba bean in the potential areas.

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