

Research Application Summary

Managing Faba bean diseases using bioinoculants in Northern Ethiopia

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Abstract

Fungal diseases have been seriously limiting faba bean production in northern Ethiopia with a serious impact on household food-security and soil fertility management. The study was initiated to evaluate the synergistic effect of host plant resistance, bio-inoculants and bio-control agents on faba bean growth and development, seed and biomass yield and incidence and severity of diseases. The experiment was set up in two sites in the Tahtay Maichew in Central Tigray, northern Ethiopia. Preliminary results have shown that there is a significant effect of treatments on dry root rot. Data on other diseases in addition to agronomic traits is being collected. After data analysis, the level of enhancement in terms of productivity of the varieties and degree of disease suppression as a contribution of bio-inoculants will be determined. The best variety- bioinoculant combination will be identified and integrated in the management of faba bean diseases in northern Ethiopia.

Key words: Chocolate spot, *Rhizobium leguminosarum*, root diseases, synergistic effect, *Trichoderma harzanium*

Resume

Les maladies fongiques ont sérieusement limité la production de la fève au nord de l'Éthiopie, ce qui a eu de graves répercussions sur la sécurité alimentaire des ménages et sur la gestion de la fertilité des sols. L'étude a été entreprise pour évaluer l'effet synergique de la résistance des plantes hôtes, des bio-agents et des agents de bio-contrôle sur la croissance et le développement de la fève, le rendement des graines et de la biomasse ainsi que l'incidence et la sévérité des maladies. L'expérimentation a été conduite sur deux sites du Tahtay Maichew, au centre du Tigray, au nord de l'Éthiopie. Les résultats préliminaires ont montré qu'il existe un effet significatif des traitements sur la pourriture des racines. Des données sur d'autres maladies en plus des caractères agronomiques sont également recueillies. Après l'analyse des données, on déterminera le niveau d'amélioration en termes de productivité des variétés et de degré de suppression de la maladie en tant que contribution des bio-inoculants. La meilleure combinaison de bio-inoculant sera identifiée et intégrée dans la gestion des maladies de la fève au nord de l'Éthiopie.

Mots clés: Tache chocolat, *Rhizobium leguminosarum*, maladies des racines, effet synergique, *Trichoderma harzanium*

Introduction and literature summary

Faba bean (*Vicia faba* L.), a major food crop widely grown in the cooler medium to high altitude areas in Ethiopia, provides the much needed protein supplement to the diet of rural households. Faba bean has been considered as a meat extender or substitute due to its high protein content (20-41 %) (Crépona *et al.*, 2010) and its haulm is an important source of livestock feed. It may also be the major and sometimes the only legume rotation crop in the cooler highlands, where other pulse crop types are least cultivated (Sahile *et al.*, 2008). However, the low grain yielding potential of indigenous cultivars and their susceptibility to biotic and abiotic stresses has lowered the productivity of faba bean in Ethiopia (Mussa *et al.*, 2008). Fungal diseases such as chocolate spot and Fusarium root rots severely constrain faba bean production in Ethiopia.

Chocolate spot (*Botrytis fabae*) is considered the most important and destructive faba bean disease causing yield loss of up to 61% in susceptible cultivars (Dereje and Beniwal, 1987). Complete crop loss due to disease has also been reported in northern Ethiopia (Abebe *et al.*, 2014). In areas where chocolate spot and other foliar and root diseases area severe, faba bean is no longer produced. Particularly in the cooler highlands of northern Ethiopia where other pulse crops other than faba bean are rarely grown, the removal of faba bean from the production system has a severe affect on the nutrition of the poor households (Crépona *et al.*, 2010). The absence of a crop capable of fixing atmospheric nitrogen, an important component in the cereal-legume crop production system is forcing farmers to depend on inorganic fertilisers.

Screening of several lines of faba bean has resulted in the identification and release of varieties with some resistance to chocolate spot disease in the country (Teklay *et al.*, 2013). However, the level of protection provided by the resistant varieties has not been satisfactory. Therefore measures should be taken to enhance the level of resistance to this disease in faba bean varieties (Saber *et al.*, 1999). To make sure that the rural community continue benefiting from the crop, measures that enhance the growth and yield of faba bean have to be sought.

Although the beneficial effect of *Rhizobium* sp. has been biological nitrogen fixation, there are reports that *Rhizobium* spp. can be used to control soil-borne pathogens of legume crops when used as seed dressing (Baraka *et al.*, 2009). In another study, combined inoculation of *Rhizobium* sp. and a bio-control fungus *Trichoderma* spp. were shown to increase growth, nutrient uptake and yield of chickpea under glasshouse and field conditions (Rudresh *et al.*, 2005). Similarly Shaban and El-Bramawy (2011) found that combined application of *Rhizobium* spp. and *Trichoderma* sp. increased mean seed weight and seed yield of legume field crops including broad bean, chickpea and lupin demonstrating that *Rhizobium* spp. and *Trichoderma* sp. could be used as biological control of some soil-borne fungal diseases. Similarly Saber *et al.* (2009) found that dual inoculation of seeds with a mixture of *R. leguminosarum* and *T. viride* followed by foliar spraying of a spore suspension of the same *T. viride* reduced chocolate spot disease and enhanced nodulation,

nitrogenase activity and nitrogen fixing bacterial population in the rhizosphere. There was about 57% reduction in chocolate spot disease and 23% increase in faba bean yield, compared to control plants. The objective of the study is to evaluate the synergistic effect of host plant resistance, use of bio-inoculants and bio-control agents on faba bean growth and development, seed and biomass yield and incidence and severity of diseases.

Materials and Methods

The experiment was conducted under natural diseases conditions. Three improved varieties, Walki, Hachallu, and Moti, with known resistance to either of the major faba bean diseases in the region (Chocolate spot, Ascochyta blight and dry root rot) and a susceptible local cultivar were included in the study. The bioinoculants *Rhizobium leguminosarum* (RL) and *Trichoderma harzanium* (TH) were obtained from the Tigray Bureau of Agriculture and Natural Resources, and the Collage of Dry land Agriculture and Natural Resources, Mekelle University, respectively.

The experiment was a factorial in a split plot arrangement with three replications. The treatments, TH, RL, RL+TH and Control (no inoculation with bioinoculants) were assigned to the main plot while varieties were sub plot treatments. The sub plot size was 2*2m with row to row and plant to plant distances of 0.4 m and 0.1 m, respectively. This study is ongoing and data on disease occurrence will be collected at a ten-day interval after disease onset. Data will be subjected to analysis of variance using Genstat14.

Expected results

The level of enhancement in terms of productivity of the varieties and level of disease suppression due to a combination of bio-inoculants and resistant varieties will be determined. The best variety- bioinoculant combination will be used for future research or integrated into the management of faba bean diseases in northern Ethiopia.

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