SUMMARY AND CONCLUSIONS

Fungicides are widely used in agriculture to control plant diseases and protect seeds or seedlings from pathogenic fungi. They may affect the growth and activity of other soil microorganisms including Rhizobium sp.

Laboratory, greenhouse and field experiments were conducted throughout this study to evaluate the effect of six common fungicides namely, Vitavax Captan, Rh_{50}, Bavistin, Tecto, Quinolate CTS and Quinolate IM, on the survival of Bradyrhizobium , japonicum in culture and on inoculated soy bean seeds. Also, to study the effect of these fungicides on nodulation, plant growth, plant nitrogen content and nitrogenase activity of soy bean plants. The seed yield as well as crude protein content of seeds were also determined.

Results obtained could be summarized as follows :

I- Effect of fungicides on the survival of Rhizobium in YMA medium :

1- The toxicity of the tested fungicides (Vitavax Captan, Rh_{50}, Tecto, Bavistin, Quinolate CTS and Quinolate IM) increased with increasing their concentration in YMA medium.

2- The fungicides Vitavax Captan and Rh_{50} were the most toxic fungicides followed by Quinolate CTS and Quinolate IM while Tecto and Bavistin had the least effect.

3- Any of tested fungicide at levels more than 1000 ppm completely inhibited the growth of both tested rhizobia strains 102 and 110.

4- Bradyrhizobium japonicum strain 102 was more sensitive to Vitavax Captan, Tecto and Bavistin and less sensitive to Rh_{50}, Quinolate CTS and Quinolate IM than strain 110.

II- Survival of Bradyrhizobium japonicum on fungicide treated seeds :

1- The number of viable cells on inoculated soybean seeds decreased by storage for several hours after inoculation : This results was in fungicide untreated and treated seeds.

2- The death rate of rhizobia cells was the greatest during the first few hours.

3- When fungicide untreated and treated seeds were inoculated and stored under direct sunlight for the same periods after inoculation, the rate of death of rhizobia cells was, generally, higher than those seeds incubated in shade at room temperature .

4- The fungicide Vitavax Captan was more toxic and sharply reduced the survival of cells on inoculated seeds more than Rh_{50} .

III- Nodulation, growth, and nitrogen fixation by soybean as affected by application of different fungicides under greenhouse conditions :

1- The number of rhizobia cells on untreated fungicide seeds inoculated with nitragin fine peat was higher than Irish peat base inoculant.

2- Application of any tested fungicide reduced the number of cells on inoculated seeds. Vitavax Captan was the most harmful followed by Rh_{50} and finally the other four tested fungicides.

3- The tested fungicides markedly varied in their inhibitory effect on nodulation, plant growth, plant nitrogen content and nitrogenase activity depending on formulation

and application dose of the fungicide. Vitavax Captan was the most toxic fungicide followed by Rh_{50} and the other tested fungicides which detected less inhibitory effects.

4- The inoculated plants gave comparable values of plant dry biomass to those plants fertilized with nitrogen fertilizer at the rate of 60 kg N/ feddan.

5- The depressive effect of fungicides on all plant parameters evaluated, increased by increasing the application dose up to 9 g/ kg seeds.

IV- Response of some soy bean varieties to rhizobial inoculation as affected by application of different fungicides:

1- The number of rhizobia cells on untreated fungicide seeds of variety Crawford was higher against the other two tested varieties.

2- Application of Vitavax Captan and Rh_{50} greatly reduced the number of rhizobia cells on the inoculated seeds. Vitavax Captan was more depressive than Rh_{50}.

3- The number and dry weight of nodules formed on the three tested soy bean varieties were markedly reduced by application of any of the tested fungicides. More reduction was recorded by increasing the application dose .

4- The uninoculated plants without nitrogen fertilizer gave the least values of plant dry biomass.

5- N- fertilization of inoculated plants enhanched the growth of plants recording higher values of plant dry biomass against the inoculated ones.

6- The inoculated plants treated with either Vitavax Captan or Rh_{50} detected lower values of plant dry matter against the untreated fungicide ones.

7- The nitrogen content of inoculated plants was higher than uninoculated plants received nitrogen fertilizer.

8- The untreated fungicide plants detected higher values of nitrogenase activity against the treated fungicide ones.

9- The nitrogenase activity was reduced by application of fungicides and the reduction was more pronounced as the application dose of the fungicide increased to 3 g/ kg seeds.

V- Assessment of nodulation, plant growth, nitrogen fixation and seed yield of soy bean as affected by application of fungicides under field conditions :

1- Nitragin fine peat inoculant counted higher numbers of B. japonicum cells in both sites (Tahnasha and Samalout) than Irish peat base one and consequently the seeds inoculated with the farmer inoculant had higher numbers of cells than those inoculated with the latter one.

2- The nodulation of the untreated fungicides plants inoculated with Nitragin fine peat was better than those of Irish peat inoculant.

3- The number of nodules on uninoculated plants either those fertilized with nitrogen or not were almost nil because of the absence of B. japonicum in Egyptian soils.

4- Any of fungicides reduced the number and dry weight of nodule and plant dry biomass, Vitavax Captan was more depressive than Rh_{50} in this respect.

5- The plant N-content values were higher in inoculated untreated fungicide plants, followed by inoculated

fungicide treated ones. The uninoculated plants received nitrogen fertilizer came in the third order while the uninoculated unfertilized plants, were the least.

6- Seed inoculation gave better nodulation and plant growth than soil application method in fungicide untreated plants. The reverse was true in fungicide treated plants.

7- Inoculation significantly increased seed yield. These increases were higher in fungicide untreated plants than those treated with fungicides.

8- Rh_{50} treated plants gave little higher seed yield than those of Vitavax Captan treated plants.

9- Inoculation or N- fertilization increased the seed crude protein over the uninoculated plants .

10- The plants grown at Tahnasha detected higher values of nodulation, plant growth, plant nitrogen content and seed yield than those of Samalout site.

From the abovementioned data, it is recommended that :

1- Inoculation of soybean with infective and efficient strains of Bradyrhizobium japonicum is necessary in Egypt as Egyptian soils were void of B. japonicum .

2- Seed inoculation is advisable for soy bean given that no seed dressing with fungicides is practisized. In case of obligatory treatment of soybean seeds with fungicides, soil inoculation with about 2 kg inoculant /feddan was recommended.

3- Inoculated seeds should be planted within 2.6 hr. after inoculation .

4- Exposure to direct sunlight should be avoided during mixing of seeds with inoculant and during storage of inoculated seeds until planting.

5- Cultivation of inoculated seeds should whenever possible, be in moist soil. Soy bean plants should be not exposed to drought effect specially at early stages of growth to get good nodulation and high N_2-fixation rates by legumes.