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INFLUENCE OF SOME BIO-, ORGANIC AND MINERAL FERTILIZERS ON MORPHOLOGICAL, PRODUCTIVE AND CHEMICAL CHARACTERS OF SOYBEAN [*Glycine max* (L.) Merr.] PLANTS

By

ZEINAB AHMED MAHMOUD SOLIMAN

B.Sc. Agric. Sci. (Biotechnology), Fac. Agric., Cairo Univ., 2015

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ABSTRACT

The present investigation was carried out at the Agricultural Experimental Station, Faculty of Agriculture, Cairo University, Giza, Egypt during the two growing seasons of 2019 and 2020. This work was designed to investigate the effect of *Bradyrhizobium japonicum* as biofertilizer, algae extract, organic fertilizer (compost) and mineral nitrogen fertilizer (ammonium sulphate 20.5%N) as different sources of nitrogen fertilization treatments, on morphology, seed yield components and chemical constituents of soybean [*Glycine max* (L.) Merr.] plants grown under sandy soil condition. Seeds were sown on May 12th of the two seasons in plastic pots (30 cm diameter). Each pot received calcium super phosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O) as a basal dressing factor. The present study included single or combined treatments of the adopted fertilizers as well as untreated plants (with no added N source). The obtained results showed that biofertilizer *Bradyrhizobium japonicum* was efficient for increasing most of the studied morphological characters, seed yield components and chemical constituents of soybean plants than those of untreated ones. Application of either algae extract or compost or mineral nitrogen as a single treatment or combined with biofertilizer (half dose of each fertilizer + biofertilizer) mostly had considerable effects on the studied characters than those of bio-inoculum as a single treatment. The combined treatment of bio-inoculum with half dose of any fertilizer caused positive effects on morphology, productivity and chemical constituents of soybean plant than those of each fertilizer used as a single treatment (full dose). The combination of ½ mineral nitrogen + bio-inoculum was the reliable treatment than the others for increasing most of the studied morphological traits as main stem length, number of secondary branches/plant, number of leaves /plant, leaf area/plant, shoot fresh weight/plant, shoot dry weight /plant, also yield components as number of pods/plant, number of seeds/plant, seed yield /plant. The highest increase induced in stem diameter achieved with the treatment of ½ mineral nitrogen + bio-inoculum due to the prominent increases in thickness of all included tissues as well as increasing diameter of pith. Also, the same treatment caused more positive effects on the studied anatomical traits of leaflet blade. The combination treatment between mineral nitrogen fertilizer as half dose and *Bradyrhizobium japonicum* was reliable treatment for increasing values of chlorophyll a, chlorophyll b and carotenoids in the fresh leaves as well as increasing percentages of N, P, K, total carbohydrates, oil and protein in air dried seeds.
Key words: Soybean, *Bradyrhizobium japonicum*, Algae extract, Compost, Nitrogen.

DEDICATION

I dedicate this work to whom my heart felt thanks to my father, my mother, my brothers, my sisters and my husband for their patience and help me all the support; they lovely offered during my post-graduate studies

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INTRODUCTION

Soybean or soyabean (*Glycine max* (L.) Merr.) is a legume crop belongs to the family Fabaceae. Soyabean is native of southeastern Asia. It is a very nutritious food being very rich in protein (32 – 42%). It has the highest lysine content (6-8%). It is an excellent food for diabetics, infants and invalids **(Bendre and Kumar,1980).** Soybean [*Glycine max* (L.) Merr.] is a very good food. As it has a high oil content, and it is rich in proteins, calcium, phosphorous, iron, potassium, magnesium and in vitamins. Soybean flour is very good for diabetic patients. Soybean oil can be used for cooking. Also, soybean oil finds many uses in industry. It is used for paints, varnishes, soaps and food products. Soybeans are also important from the point of view of animal nutrition, to which they contribute by their seeds, hulls and the green parts. Soybean being a legume, makes the soil more fertile when it is grown **(Pandey, 1980)**. The oil of soybean contains 85% unsaturated fatty acids and is cholesterol free. Soybean seeds contain 43.2% protein, 19.5% fat, 20.9% carbohydrate and a good amount of other nutrients like calcium, phosphorous, iron and vitamins. Soybean has 3% lecithin which is helpful for brain development. **(Rahman, 1982).** Soybean has the highest protein content among leguminous plants, and the yield of edible protein is one of the highest of all plant or animal protein sources. The nutritional quality of soybean protein is the best a viable from plant sources. It is considered a major crop for industrial, human food and animal feed uses. Plants could be cut for hay, silage or ploughed as green manure. **(Soliman, 1984).** Soybean is

one of the most important oil seed crops. Oil and protein rich soybean have now been recognized as a good potential supplementary source of edible oil and nutrition **(Kaul and Das, 1986).** Soybean is the richest, cheapest and easiest source of best quality protein and fat. Soybeans have high amount of protein and oil, and they are used into diverse food products, including soy curd, fermented soy cakes, soy sauce, soy paste and soy milk. Such hydrolyzed protein is a meat substitute used for many people. Soy oil is used in cooking, as well as in industrial products (paints, printing inks, disinfectants, biofuel and linoleum). The soy derivatives that remain after oil extraction is used to produce fiber, textiles, adhesives, and livestock feed. There are several different fatty acids present in the soy oil. Soybean oil contains a high number of unsaturated acids important in the human nutrition: α-linolenic acid (omega-3 acid), linoleic, γ-linolenic, arachidonic acid (omega-6 acid) and oleic acid known as omega-9 **(Olguin *et al.*, 2003 and Nikolic *et al.*, 2009).** Soybean protein is rich in the valuable amino acid lysine (5%). In addition, it contains good amount of minerals, salts and vitamins, thiamine and riboflavin **(Singh *et al.*, 2003).**

Soybean is a good source of iso-flavones. It helps in preventing heart diseases and cancer **(Kumar, 2007).**

Biofertilizers are microbial inoculants used for application to either seeds or soil for increasing soil fertility with objective of increasing the number of micro-organisms and accelerate certain microbial processes. Such microbiological processes can change unavailable forms of nutrients into available ones that can be easily assimilated by plants **(Subba Rao, 1981).** Biofertilizers were useful for