EVALUATION OF SOME FERTILIZERS FOR INCREASING NITROGEN EFFICIENCY UNDER EGYPTIAN CONDITIONS

By

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ABSTRACT

Pot-experiments were carried out in green-house, to evaluate the effect of inoculation with either bacteria or incorporation of azolla, on growth parameters and N_2-fixed by legumes (soybean) or cereals (wheat or rice). ^{15}N-enriched urea or ammonium sulfate had been also used as chemical fertilizers.

The obtained results, indicated that either inoculation or N-fertilization had increased the dry matter yields and nitrogen uptaken by the tested crops as compared with the control treatments. Generally, the application of chemical fertilizers in combination with inoculants, reflected that inoculation had increased the fertilizer use efficiency (FUE %). Using N-15 enriched nitrogen fertilizers revealed that, about 40-60%, 7-25% and 63% of the uptaken nitrogen was compensated by N_2-fixation, via inoculation of soybean, wheat and rice plants, respectively.

Dual inoculation with *Rhizobium* plus *Azospirillum*, *Azotobacter*, and dry *Azolla* in case of soybean, wheat and rice, respectively was superior over the other inoculation treatments.

The obtained results showed that about 50-60% of the chemical fertilizers could be saved and substituted by biofertilizers. Economical return, as well as, the environmental impact had been also discussed.

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LIST OF ABBREVIATIONS

ANI	:	Added nitrogen interaction.
ARA	:	Aceytelne reduction activity.
ARC	:	Agriculture Research Center.
Azot	:	*Azotobacter.*
BNF	:	Biological Nitrogen Fixation.
DAZ	:	Dry *Azolla.*
FAZ	:	Fresh *Azolla.*
FUE	:	Fertilizer use efficiency.
IRRI	:	International Rice Research Institue.
LAS	:	Labelled ammonium sulfate.
LU	:	Labelled urea.
^{15}N % a.e.	:	Percent N-15 atom excess.
N_2-ase	:	Nitrogenase.
Ndfa	:	Nitrogen derived from air.
Ndff	:	Nitrogen derived from fertilizer.
Ndfs	:	Nitrogen derived from soil.
Rh	:	*Rhizobium.*
SP	:	*Azospirillum.*
TPNinc	:	Total plant nitrogen of inoculated plant.
TPNcon	:	Total plant nitrogen of uninoculated plant.

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INTRODUCTION

Nitrogen is essential and is considered as a limiting factor for crop production in Egypt. Chemical nitrogen fertilizers inputs had been increased during the last decades. According to FAO (1990), the Egyptian growers had consumed more than 37% of the African's consumption of nitrogen fertilizers. This luxury use of nitrogen fertilizers was accounted to about 4.983 x 10^6 tons annually, according to the annual statistical book, A.R.E. (1990).

The efficient use of nitrogen fertilizers was low due to the high values of pH, high temperature and in some cases, the high content of calcium carbonate, as well as the misuse of irrigation water. These conditions are considered the most factors which are responsible for the great losses of nitrogen fertilizers through denitrification and/or NH_3-volatilization. Under logging conditions, NO_3 leaching is the main source of nitrogen losses. Therefore, the losses from nitrogen fertilizers are within the range of 50-60% from the total applied nitrogen. Moreover, the lost nitrogen may act as pollutant for soil, water and air, and become harmful for life of human being on earth.

Recently, great attention has been focused on the use of alternative sources or renewable agents for increasing soil fertility, crop production and maximizing nitrogen use efficiency. These alternative sources are called

"Biofertilizers". and could be recognized as useful technology for reducing the input of nitrogen fertilizers in agriculture and controlling soil and water pollution. In recent years, biofertilization technology had been applied on a large scale in the world. but it is still at the primary stages in Egypt. As far as the literature had been widely reviewed concerning studies of biofertilization on crop production under Egyptian conditions. yet the obtained results should suffice to emphasize the importance of further investigations in this direction. In order to perform a contribution on biofertilization. series of experiments must be conducted in order not only to shed light on its beneficial effects for higher crop production, but also for practical reasons to solve the problem of maximizing nitrogen use efficiency and consequently a parallel acceleration in minimizing environmental pollution.

In essence then. the current study is an endeavour to expose the effects of:

1. Single biofertilization with non-symbiotic nitrogen fixing bacteria as bacterial inoculation with *Azotobacter and Azospirillum* on wheat plants.

2. Single biofertilization with symbiotic nitrogen fixing bacteria as bacterial inoculation with *Rhizobium* on soybean plants.

3. Single biofertilization with symbiotic nitrogen aquatic fern either as green *Azolla* intercropped with rice or