Studies on influence of PPFMs and Rhizobium inoculation on BNF in Faba bean and Chickpea

ABSTRACT:

Faba bean and Chickpea genotypes were evaluated genotypes under natural conditions, treatment with improved rhizobia and with PPFMs. Two experiments were laid out in Sids station, Bani Suef Governorate. Total nitrogen (N%) was estimated by Kjeldahl method at ARC (Cairo, Egypt). Significant to highly significant phenotypic correlation between plant nitrogen content , dry plant weight, nitrogen, N-fixed by air and Ndfa. In faba bean plant nitrogen content increased significantly from 238.64 to 284.23 and 360.56 mg/plant when inoculated with Rhizobia only and Rhizobia and PPFMs respectively. In Chickpea the treatment with Rhizobia showed the highest values for PNC although dry weight of nodules/plant was significantly higher in rhizobia treatments with PPFMs. Two faba bean accessions 45/018/F8/7307/06A and Sakha1 showed the best nitrogen content comparing to other genotypes.

INTRODUCTION

The increasing concern regarding enough food to meet the growing human population demand has been reinforcing the importance of sustainable intensification of agricultural practices which includes legume crops for their ability of biological nitrogen fixation. Faba bean (*Vicia faba* L.) and chickpea (*Cicer arietinum* L.) are major legume crops cultivated in the Mediterranean countries and the process of BNF is helpful to fix up atmospheric nitrogen at least 120 kg N ha^{-1} (Jensen et al., 2010). The use of pink-pigmented facultative methylotrophic bacteria (PPFMs) may increase nitrogen fixation which benefits not only the crop itself but the followed crop.

This research aimed to evaluate the response faba bean and chickpea genotypes under natural conditions, treatment with improved rhizobia and with PPFMs.

RESULTS

- Highly significant phenotypic correlation have been detected between nitrogen fixed by air (Ndfa) and the all measured traits in faba bean.
- significant differences were detected between nitrogen content in the plant with dry plant weight (PW) and nitrogen fixed by air (Ndfa) in chickpea
- In faba bean PNC was increased from 238.64 to 284.23 and 360.56 mg/plant when inoculated with Rhizobia only and Rhizobia and PPFMs respectively.
- In Chickpea the treatment with Rhizobia showed the highest values for PNC although dry weight of nodules/plant was significantly higher in rhizobia treatments with PPFMs.
- Two faba bean accessions 45/018/F8/7307/06A and Sakha1 showed the best PNC comparing to other genotypes

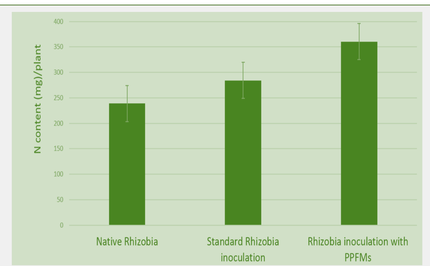

Figure 1: N content (mg $plant^{-1}$) in three different Rhizobia treatments in faba bean

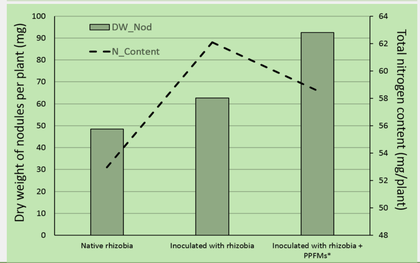

Figure 1: Figure 1: Dry weight of nodules per plant (mg) and total N content (mg $plant^{-1}$) in three Rhizobia treatments

MATERIALS AND METHODS -

25 faba bean and 24 Chickpea accessions (Table 1) were evaluated in two different experiments at ARC Sids station, Bani Suef Governorate (Egypt) in Randomized block design with two replications, two Rhizobia treatments with and without PPFMs.

The following data were recorded:

- Number of Rhizobia/plant counted in five plants
- Dry weight of Rhizobia measured in five plants.
- Total nitrogen (N%) estimated by Kjeldahl method at ARC (Cairo, Egypt).
- Plant nitrogen content (PNC) calculated by the formula

Dry plant weight x N% x 10

- N-fixed by air estimated by the following formula:

(PNC x Ndfa)/100.

- ^{15}N measured using Chalk (1985)

Analysis of variance was conducted for all evaluated traits.

Table 1: Accessions of faba bean and Chickpea evaluated for BNF

ID No.	Faba bean lines	ID No.	Chickpea lines
1	C09/4/Giza 4-L 47-4/09	1	S090021
2	C09/1/THB7F8/7723/06-LS1-1/09	2	FLIP08-85C
3	C09/1/ THB7F8/7089/06-L76-1/09	3	FLIP08-90C
4	90/08/F8/7708/06-S97112 (1LB436SXBPL2282)	4	FLIP08-91C
5	93/08/F8/7711/06-s97112 (1LB436SXBPL2282)	5	S090612
6	49/08/F8/7332/06-HBP/S0E/2000	6	FLIP08-93C
7	94/08/F8/7102/06-S97112 (1LB4365XBPL2282)	7	S091013
8	45/0/8F8/7307/06-A-HBP/S0E/2000	8	S091065
9	60/0/8F8/7002/06	9	S090105
10	2/10/8F8/7102/06-HBP/S0D/2000	10	S090642
11	0/08/F8/7002/06	11	S090714
12	95/08/F87713/06	12	S091440
13	45/018F87307/06A	13	FLIP07-176C
14	86/08/F8/7604/06	14	FLIP08-46C
15	37/08/F8/7218/06	15	FLIP08-72C
16	C08/Fam/242Ter2XB7/902S/06	16	FLIP08-19C
17	C08/Fam/92/Ter9XB7/9012/06	17	FLIP05-37C
18	C08/Fam/392Ter10XB7/9074/06	18	FLIP05-47C
19	Giza3X123A/4S/76	19	FLIP06-173C
20	HBP/S0A/2005 (B0txEMXLA)-L-B	20	FLIP08-52C
21	HBP/S0B/2005 (EM	21	FLIP02-47C
22	HBP/DSO/2000/2438-2/2009	22	FLIP03-99C
23	HBP/DSO/2000/2438-4/2009	23	FLIP08-50C
24	S980/9 (Bc)	24	FLIP08-141C
25	Sakha 1		

DISCUSSIONS–

Our results indicated that the use of PPFMs increased nitrogen fixation substantially comparing the native and improved Rhizobia in both crops.

In case of faba bean, rhizobium nodulation was found highly correlated with nitrogen fixed by air. Therefore selection for high nitrogen fixation in faba bean could be achieved by measuring the number of rhizobia/plant,

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