Effect of different nitrogen and biofertilizers effect on growth and yield of *Brassica napus* L.

Mahboobeh Naderifar¹, Jahanfar Daneshian²

1. Department of Agronomy, Takestan Branch, Islamic Azad University, Takestan, Iran
2. Seed and plant improvement institute, Karaj, Iran

**Corresponding author email:** naderifar151@yahoo.com

**ABSTRACT:** Nitrogen different levels and biofertilizers effects were studied on growth and yield of canola in Qazvin province. An experiment was conducted in a split-plot design as base of randomized complete block design with four replications. Treatments included 3 levels of nitrogen (0, 75 and 150 kg ha⁻¹) and bio-fertilizers on four levels (not inoculation, *Azotobacter*, *Azospirillum* and withinoculation combined). The results showed that nitrogen had significant effect on the seed number per silques, number of silques per plant, seed yield, 1000 seed weight, seed yield and Plant height. So that with the increased use of nitrogen fertilizer, all of these traits increased and the combined use of was also increased on Seed yield. Interaction of nitrogen and biofertilizers affected on seed yield, significantly. Using of nitrogen fertilizer in amount of 2195 produce the highest seed yield when seeds were inoculated by biofertilizers. 150 N(kg ha⁻¹) and non inoculation produced the highest seed yield. The combined use of biofertilizers also was statistically superior to other treatments. However, the highest yield was got from 150 but it seems using of 75 N(kg ha⁻¹) and inoculation of *Azospirillum* and *Azotobacter* produced suitable yield (20% loss).

**Key words:** Brassicanapus L., Azotobacter, Azospirillum, Nitrogen

**INTRODUCTION**

Canola (*Brassica napus* L.) production after soybean and palm is the third largest oilseed crop, producing as much as 14.7% of total vegetable edible oil in the world (Yasari *et al*., 2008). Total demand for vegetable edible oil in Iran based on 13.5 each person consumption with 70 million population reaches to 945 thousand tones per year, giving a huge drain to the economy (Yasari *et al*., 2007). Canola is nitrogen demanding crop plant. Nitrogen plays vital role in its healthy growth and is one of the main precursors of protein which absorbs in the form of mineral, ammonium or nitrate by canola plant like the other crops (Hopkins and Hunter, 2004). The seed yield, total dry matter and harvest index in some genotypes of *Brassica napus* and *Brassica juncea* has been found to improve with higher rates of N (Sharma *et al*., 1997; Kumar *et al*., 2001; Cheema *et al*., 2001; Miller *et al*., 2003; Kopsell *et al*., 2004). Hocking and Strapper (2001) reported a linear correlation in increasing seed and oil yield with an increased level of nutrient availability. Ali *et al*. (1990) observed that the number of silques in sub-branch and total number of silques in plant showed an increasing trend with increased in levels of nitrogen.

Intensive use of chemical fertilizers and other chemicals has produced environmental problems and increased production costs. There centesimo miccris and environmental problems has raised interest in environmental friendly sustainable agricultural practices, which can reduce input costs (Salanturet al., 2005). N2-fixing maybe important for plant nutrition by increasing N uptake by the plants and playing significant troles in plant growth promote rhizhizo bacteria (PGPR) in the bio fertilization of crops. Plant growth-promoting rhizobacteria (PGPR) are able exit beneficial upon plant growth. Nitrogen fixation and P. Solubilization (Zaidi et al., 2006) production of antibiotic (Zahiret al., 2004) and increased rood day weight are the principal mechanism for the PGPR. A number of different bacteria promote plant growth, including Azotobactersp, Azospirillumsp., Pseudomonessp. Bacillus Acetobactesp (Turan, 2006).

PGPRs have gained worldwide importance and acceptance for agricultural benefits. These microorganisms are potential tools for sustainable agriculture and a trend for the future (podile *et al*., 2006). The use of rhizosphere-associated microorganisms as biofertilizers is now considered as having potential for improving plant productivity (Vessey, 2003). Vessey(2003) defined biofertilizers as substances which contain
living microorganisms and when applied to seed, plant surfaces or soil colonize the plant and promote its growth by increasing the nutrient availability. Rhizosphere-associated nitrogen fixing and phosphate-solubilizing bacteria have been used as inoculum for nonlegume crop species such as corn, rice, wheat and sugarcane (Dobereiner, 1997 and Schilling et al., 1998). The action mechanisms of PGPRs can be divided also into direct and indirect ones. Direct mechanisms include N2-fixation, soil mineral solubilization, production of plant-growth-promoting substances (auxins, cytokinins or gibberellins) and reduction of ethylene levels, among others. Indirect mechanisms include favoring colonization by other beneficial soil microorganisms, as mycorrhizal fungi, and repressing the growth of plant pathogenic microorganisms (Lugtenberg et al., 2009 and Marulanda et al., 2010).

Bacterial genera Azotobacter, Azospirillum and Pseudomonas are the most important plant growth promoting rhizobacteria, which affect on growth, development and yield of the crop (Zahir et al., 2004). Other reasons are related to producing amino acids, carbohydrates, organic acids and growth simulating materials (Singh et al., 2004). Therefore, the present research was carried out to evaluate the effects of different nitrogen levels and biofertilizers on yield of canola plants.

MATERIALS AND METHODS

This experiment was carried out in order to investigate effect of nitrogen different levels and biofertilizers on yield of canola plants in Qazvin province, Iran. The experimental design was split-plot based on randomized completely block design in four replications in Ismael Abad Researches Station during 2009-2010, where the latitude is 36N and longitude 16E with an elevation of 1285 m above the sea level. Mean precipitation per year was 310-320 mm and Mean temperature per year was 9.13 °C. The experimental soil was slightly-loom textually with pH of 7.9-8 which was slightly alkaline and EC of 1-1.39×10−3 ds m−1. Each replication of this design consisted of 12 treatments. And a total of 48 plots were analyzed. The factors examined were four levels of nitrogen (0, 75 and 150 kg ha−1 nitrogen) equal to the application of 0, 150 and 300 kg ha−1 of urea, as main plot, respectively and also biofertilizer included in 4 levels (non inoculation, Azotobacter, Azospirillum and Azotobacter +Azospirillum inoculation combined) comprised the sub plot factors.

The area of each main plot was 6x12 m and that of sub plot was 6x2.4 m. There was a 6 m distance between two adjacent main plots in order for nitrogen fertilizer to prevent moving to the next plot. There was a 60 cm distance between two adjacent sub plots as well. There were 12 plots in each block and the treatments were allocated randomly to each plot. Seeds were moistened with 10% sugar water and inoculated with 30 gram inoculation including 10^7 alive and active bacteria before planting. Total amount of recommended doses of P(150 kg ha^-1) and S (100 kg ha^-1) fertilizers based on soil physico-chemical test. Result was broadcasted and incorporated to the experimental soil prior to canola cultivation. Nitrogen fertilizer but was added in three splits: Nitrogen fertilizer but was added in three splits: 1.3rd at cultivation time as basal fertilization, 1.3rd at stem initiation stage and the remaining 1.3rd was applied at bud initiation before flowering stage in accordance with the treatment variables. Determinate traits includes seed number per silique, number of silques per plant, 1000 seed weight, seed yield and Plant height. Statically analysis was conducted using MSTAT-c software. Mean comparison was also conducted with Duncan’s Multiple Range Test (DMRT).

| Table 1: Soil physical and chemical properties of experimental area |
|------------------|------------------|------------------|------------------|------------------|
| PH | E.C (dS/m) | Organic Carbon (%) | Total N (%) | Available K (mg kg^-1) | Available P (mg kg^-1) | Soil texture |
| 7.9-8 | 1-1.39 | 0.5-0.8 | 0.05-0.08 | 215-308.5 | 7-11.2 | Loam |

RESULTS AND DISCUSSION

Results obtained from analysis of variance indicated that there are significant difference between nitrogen fertilizer, biofertilizer and their interaction effects on seed yield (Table 2). The lowest seed yield was observed in non application nitrogen fertilizer treatment increased with using nitrogen fertilizer. The highest seed yield belong to bio fertilizers followed by nitrogen fertilizer. In general Azotobacter followed by nitrogen fertilizer can increase seed yield and yields components by positive influence on macro elements absorption such as N, P and K (Narula et al., 2000), micro elements such as Zn and Fe (Wani et al., 1988), improving water distributing in plant, developing Nitrate Redoctaz activity and finally producing plant hormones which have an important role in plant growth. These results are agreed with Singh et al. (2004) who believed to maximize production of different wheat cultivars which inoculated with Azotobacter under normal conditions. Results obtained from this study showed that with using...
biofertilizer inoculation methods, not only seed yield can be improved but also consumption of nitrogen chemical fertilizer reduces remarkably.

The analysis of variance showed that the effects of (150 kg ha\(^{-1}\))N treatment and the effects of biofertilizer on plant height were significant (Table 2). Plant height in inoculation with each of the bacteria compared to non inoculation treatment was significantly different and superior. Maximum height belonged to inoculation treatments with application of combined biofertilizers (121.3cm) (Table 3).

Table 2. Analysis of variation for the studied traits

<table>
<thead>
<tr>
<th>S.O.V</th>
<th>D.f</th>
<th>Plant height</th>
<th>seed yield</th>
<th>1000 seed weight</th>
<th>number of silques per plant</th>
<th>Seed number per silique</th>
</tr>
</thead>
<tbody>
<tr>
<td>replication</td>
<td>3</td>
<td>367.535</td>
<td>90034.211</td>
<td>0.406</td>
<td>159.019</td>
<td>15.63</td>
</tr>
<tr>
<td>nitrogen</td>
<td>2</td>
<td>4352.021**</td>
<td>5668170.081**</td>
<td>4.876**</td>
<td>4884.021**</td>
<td>410.083**</td>
</tr>
<tr>
<td>Error</td>
<td>6</td>
<td>54.868</td>
<td>75810.555</td>
<td>0.148</td>
<td>56.722</td>
<td>4.042</td>
</tr>
<tr>
<td>bio fertilizer</td>
<td>3</td>
<td>336.785*</td>
<td>368.219787*</td>
<td>0.271**</td>
<td>11.339</td>
<td>3.047**</td>
</tr>
<tr>
<td>Nitrogen × biofertilizer</td>
<td>6</td>
<td>71.264**</td>
<td>723.210488**</td>
<td>0.009**</td>
<td>11.396</td>
<td>0.333**</td>
</tr>
<tr>
<td>Error</td>
<td>27</td>
<td>83.155</td>
<td>50318.278</td>
<td>0.007</td>
<td>31.506</td>
<td>0.645</td>
</tr>
<tr>
<td>CV</td>
<td>3</td>
<td>7.97%</td>
<td>11.19%</td>
<td>4.43%</td>
<td>7.39%</td>
<td>3.86%</td>
</tr>
</tbody>
</table>

**Significant at 0.01 level, *Significant at 0.05 level and ns: Non significant

The results showed that nitrogen and biofertilizers had significant effect on1000 seed weight at 1%level. So that the highest 1000 seed weight obtained from 150 kg ha\(^{-1}\)N treatment. The trait of 1000 seed weight also increased due to inoculating seed with studied bacteria in compared with non inoculation. Biofertilizers improved photosynthesis maybe by increasing water and nutrients absorption leading to produce more assimilate and improve plant growth and thus, 1000 seed weight increased in compared with non inoculation treatment. Hamidi et al. (2007) reported that 1000 grain weight increased by multiple inoculation compared to single inoculation.

seed number per silques influenced by nitrogen fertilizer and biofertilizer treatments (Table 2). This trait increased by increasing Nitrogen level. The lowest seed number per silques belonged to non inoculation treatment. Biofertilizers caused to increasing seed number per silques; both kinds of bio fertilizers had same effects on this trait. In an investigation, Khan et al. (2002) suggested that the maximum number of silques in main stem resulted with maximum doses of nitrogen. Assess to number of silques per plant revealed that application of nitrogenous fertilizer resulted to increase silques per plant. Application of 150 kg ha\(^{-1}\) and inoculation treatments had most silques per plant.

Table 3. Means for studied traits in canola under seed inoculated

<table>
<thead>
<tr>
<th>Nitrogen (kg ha(^{-1}))</th>
<th>Biological fertilizer height Plant(cm)</th>
<th>seed yield (kg ha(^{-1}))</th>
<th>1000 seed weight (g)</th>
<th>number of silques per plant</th>
<th>Seed number per silique</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Biological fertilizer height Plant(cm)</td>
<td>seed yield (kg ha(^{-1}))</td>
<td>1000 seed weight (g)</td>
<td>number of silques per plant</td>
<td>Seed number per silique</td>
</tr>
<tr>
<td>75</td>
<td>Biological fertilizer height Plant(cm)</td>
<td>seed yield (kg ha(^{-1}))</td>
<td>1000 seed weight (g)</td>
<td>number of silques per plant</td>
<td>Seed number per silique</td>
</tr>
<tr>
<td>150</td>
<td>Biological fertilizer height Plant(cm)</td>
<td>seed yield (kg ha(^{-1}))</td>
<td>1000 seed weight (g)</td>
<td>number of silques per plant</td>
<td>Seed number per silique</td>
</tr>
<tr>
<td>Non inoculation</td>
<td>Biological fertilizer height Plant(cm)</td>
<td>seed yield (kg ha(^{-1}))</td>
<td>1000 seed weight (g)</td>
<td>number of silques per plant</td>
<td>Seed number per silique</td>
</tr>
<tr>
<td>Azotobacter</td>
<td>Biological fertilizer height Plant(cm)</td>
<td>seed yield (kg ha(^{-1}))</td>
<td>1000 seed weight (g)</td>
<td>number of silques per plant</td>
<td>Seed number per silique</td>
</tr>
<tr>
<td>Azospirillum</td>
<td>Biological fertilizer height Plant(cm)</td>
<td>seed yield (kg ha(^{-1}))</td>
<td>1000 seed weight (g)</td>
<td>number of silques per plant</td>
<td>Seed number per silique</td>
</tr>
<tr>
<td>Azotobacter and Azospirillum</td>
<td>Biological fertilizer height Plant(cm)</td>
<td>seed yield (kg ha(^{-1}))</td>
<td>1000 seed weight (g)</td>
<td>number of silques per plant</td>
<td>Seed number per silique</td>
</tr>
</tbody>
</table>

Values followed by the same letters are not significantly different at 5% level

The mean comparison showed that increasing the levels of nitrogen application resulted in increased canola seed yield and yield components, number of seeds per silique (25.84), number of silquesper plant (93.22), 1000 seed weight (2464 kg ha\(^{-1}\)), Plant height (130.3cm) and finally seed yield(2588 kg ha\(^{-1}\)) was obtained with the application of maximum level of nitrogen (150 kg ha\(^{-1}\)). The minimum value of the above mentioned characteristics, i.e., the minimum number of seeds per silique (15.72), the minimum total number of silques in
plant (58.28siliques), minimum 1000 seed weight (1.36 1 g), minimum Plant height (97.38 cm) and finally the minimum seed yield (1399 kg ha\(^{-1}\)) resulted with no nitrogen treatment control plots. Favorable reports exist on canola seed yield by application of N fertilizer (Ozer, 2003; Hocking et al., 2003) and N being a structural component of nucleic acid, protein and nucleoprotein its application does favor significantly the seed yield, LAI and TDM in canola and other Brassica species (Lickfett et al., 1999).

The mean comparison showed that Application of all treatments of biofertilizers also had superior compare to non inoculation, that could de refer to nitrogen fixation.

![Figure 1. interaction nitrogen and biological Fertilizer treatment the seed yield](image)

**CONCLUSION**

In general, using biofertilizers and manage integrated nourishment quantitatively and qualitatively is one of the efficient ways to improve plants production and environment would have a better condition if chemical fertilizers consumption reduce. The combined use of biofertilizers also was statistically superior to other treatments. In this experiment, inoculation of canola seed with PGPRs showed significant effects on yield and other studied traits. The highest yield was got from 150 but it seems using of (75 kg ha\(^{-1}\)) Nitrogen and inoculation of Azospirillum and Azotobacter produced suitable yield. It seems that can be save to fertilizer by application of biofertilizers combined chemical fertilizers. that using biofertilizers also improving soil physiological structure and also increase organic matters content and nitrogen available to coexistent plant.

**REFERENCES**


