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# Evaluation of Biological Fertilizers Potential for Providing Nitrogen Need in Pumpkin (*Cucurbita pepo*)

*Reza Irannejad, Sassan Rezadust and Mohsen Rushdi*

Department of Agronomy and Plant Breeding, Khoy Branch, Islamic Azad University, Khoy, Iran

**Abstract:** In order to study the effect of biological fertilizer, Nitroxine and Nitrajine, in providing nitrogen need in Pumpkin, an experiment was done during 2010 in the "Agricultural Research Station of Khoy". The fertilizer treatments includes: control, Nitroxine, Nitroxine + 25% Urea, Nitroxine + 50% Urea, Nitroxine + 75% Urea, Nitrajine + 50% Urea, Nitrajine + 75% Urea, Nitroxine + Nitrajine, Nitroxine + Nitrajine + 25% Urea, Nitroxine + Nitrajine + 50% Urea, Nitrixine + Nitrajine + 75% Urea. The results showed that the maximum flower numbers per unit area was 23 exist in 12 treatment and the greatest fruits (5585 $gm^{-2}$) presence in the same plot. The highest yield was in 6, 8, 9, 10, 11 and 12 treatments, respectively (230, 267.6, 258.5, 268, 260 and 250 $gm^{-2}$) and the least yield relates to 1 and 2 treatments (88 and 59.9 $gm^{-2}$). The highest proportion of the core to the kernel seed is pertaining to fertilizer treatment of 12(8.25%) and the least one relates to fertilizer treatment 1(4.12%). The least total yield in control treatment was with 337g/ $m^2$ and the most total yield in treatment 12 was with 2993$gm^{-2}$. The percentage of hollowness of the seed was not affected by fertilizer treatment and oil yield was maximum in treatment 12, respectively. According to the results which have done fertilizer treatments Nitroxine + Nitrojine alone and Nitroxine + Nitrojine + 75% Urea have a lot of potentials in providing nitrogen need in Pumpkin in order to achieve the highest production.

**Key words:** Biological fertilizer · Hollowness percentage · Nitrogen · Oil percentage · Pumpkin

## INTRODUCTION

At this time ²biological fertilizer are introduced as a substitute alternative for chemical fertilizers as they increase soil fertility in order to achieve the stable production of agricultural products [1].

Biological fertilizers are in fact substances include different kinds of free living tiny creatures [2], which have the ability to convert the main food elements from unavailable forms during biological processes [3] and lead to developing the root system and a better germination of the seeds [3] .A group of such bacteria species which has the cooperative ability with the plant belong to Azotobacter²Azospirillum and Pseudomonas [4, 5].

Biological fertilizer ²Nitroxine² has a positive effect on the yield wheat yield components such as bush height² cluster length and the member of seeds [6]. This fertilizer was produced by Asian biological technology institute. The share of each bacteria species per millimeter of Nitroxine is as 108 live cells in (CFU) number [7]. Nitrogen biological fixation estimated approximately 106x180 square meter in universal scale per ton each year among which 80 percent was done by symbiosis bacteria and the remaining 20 percent by cooperation and free living bacteria. Nowadays Nitrogen's biological fixation is important through free living bacteria such as Azotobacter and Azospirillum in agricultural systems and ask for a special consideration [5].

Azotobacter and Azosprillum have the ability to produce an active biological substance in the root environment which has a useful effective role in increasing root growth [8].On the other hand² Azobacter is capable of producing some useful fungus mixtures against plant diseases and it also causes an increase in germination and strong seedling which is followed by improvement in plant root [4].

Azosprillum leads to an improvement in root growth and increase in the speed of water absorption and food ingredients through releasing of some growth stimulating substances and this is effective in yield increase [5]. The most advantage of such fertilizer which is the most natural and favorable solution in vitality of soil is supplying organic matters to soil in order to replicate its needs [5].

**Corresponding Author:** Reza Iranneja, Department of Agronomy and Plant Breeding, Khoy Branch, Islamic Azad University, Khoy, Iran.

In addition to such providing nutritional elements as completely coordinate with plant's natural feeding helping in biological variation strengthening vital activity quality improvement and keeping environmental health are account for the most important advantages of biological fertilizer [9]. Rusta *et al*. (1998) reported increasing in the height of hybrid corn which was inoculated with Azospirillum.

Shalan (2005) claimed that black caraway(Nigella sativa) seeds inoculating with biological fertilizers such as Azotobacter and Azospirillum leads to an improvement in the characteristics of plant growth such as plant's height and the main reason of this fact relies on increasing in the nutritional attractions by the plant. Kapulnik *et al*. (1982) claimed that inoculating corn seeds with Azopirillum leads to an increase in the number of this plant and finally comparing to the control. Hamidi *et al.* (2006) survey showed that by inoculating silage corn seed with Azospirillum the number of formed leaves at the top of maize in the whole bush was increased. The reason of this fact was considered as the positive relationship between plant and bactetrium . Stan Choi *et al.* (1992) showed that the biomass was increased as a result of inoculating corn with Azospirillum .Nanda *et al.* (1995) claimed that inoculating corn seed with biological fertilizer of Azospirillum and Azotobacter to a significant increase in foilage yield of this plant. Research results of Yousef *et al* (2004) showed that in garden sage, the use of biological fertilizers, leads to a rise in plant height and the wet and dry weight of plant's shoot. The results of Sharifi and Haghnia (2002) showed that biological fertilizer, Nitroxine, in wheat leads to an increase in seed yield. Many researchers has pointed out the following positive role and the growth stimulating bacteria on plant growth and they relates that to plant hormone secretion, producing and releasing of a variety of organic acids in soil nitrogen fixing and finally positive interactions among them and other soil creatures .This is a domestic plant of tropical and semi_tropical areas of south America and its cultivation was prevalent 2000 years B.C in Peru [15]. Nowadays, in many parts of America, Europe, Australia it is cultivated for a variety of usages such as pharmacy and lubrication industry especially, nut consumption [16, 17].

The purpose of this survey: comparing different concentrations of biological fertilizer, Nitroxine and Nitrajine on pumpkin yield, the possibility of biological fertilizer effect on a decrease in chemical fertilizer consumption and studying the possibility of substitution of biological fertilizer with chemical ones.

Table 1: The results of soil test

| (sampling depth 0-30) | Properties |
|---|---|
| EC | 0.59 ($dSm^{-1}$) |
| pH | 8.3 |
| Lime | 11 (mg/kg) |
| Clay | 17% |
| Silt sand | 37% |
| Nitrogen | 46% |
| | 0.05% |

## MATERIALS AND METHODS

The experiment was carried out during 2009- 2010 in Agricultural Research Station and Natural Resources of Khoy, Iran (Latitude 38° 32' North and Longitude of 44° 55' East). In this survey,12 fertilizer treatment with a randomized complete block design in 3 replications was experimented. Fertilizer treatment includes: control, Nitroxine, Nitroxine + 25 % Urea, Nitroxine + 50% Urea, Nitroxine + 75 % Urea, Nitrajine, Nitrajine + 25% Urea, Nitrajine + 50% Urea, Nitrajine + 75% Urea, Nitroxine + Nitrajine + 25% Urea, Nitroxine + Nitrajine + 50% Urea, Nitroxine + Nitrajine + 75% Urea. To specify the features of field soil, a sample was taken from 0-30 centimeters depth.The results are shown in Table 1.

To prepare the field in the beginning of spring, the field was ploughed and then the soil was leveled .The area of each field experimental plot was 23 m2 (3.53 m,6.5m). The seeds are soaked in biological fertilizer solution for 24 hours with a concentration of one and a half liter per hectare (according to the kind of treatment) and seeded in wide hill with 5 centimeters depth and covered with light and moisturized soil . The cultivation operation was done on 28th of May. The cultivated seed was local brand of Hamedan. The distance between planting row was 120 centimeters and in each field experimental plot 3 cultivation lines was considered in 6.5 meter length. The distance of plants on each cultivation line to achieve the accumulation of 565, 19 plants per hectare, was 40 centimeters.

In four leaves stage, thinly scattered operation was done, the strongest plant was maintained and the removed.

According to the results of soil test and soil Nitrogen need, the needed amount of Urea fertilizer for each experimental plot was calculated and half of which was consumed before cultivation and the remaining used in pollination stage. Weed control until canopy closing was done manually during 2 stages. Irrigation was done each 7 to 9 days with rain until the end of growing growth

stage and it is done with field experimental plot from blossom stage to the ripening time of fruits. Data analysis of variance was performed according to the randomized complete block design with MSTATC and drawing of curves with Excel software. To compare treatment mean, the LSD test was also used at probability level of 5 %.

## RESULTS AND DISCUSSION

Data of analysis of variance showed that fertilizer treatments have a significant statistical effect on the number of flowers ² fruit weight² seed dry weight ratio of kernel to testa ²oil yield and harvest index (Table 2).

According to the results illustrated in Fig. 1 fertilizer treatment 12 has assigned the height (23 numbers) and the treatments 1, 3, 6(8.4, 9.7 and 12.3, respectively) has the least number of flowers to themselves. Increasing the number of flowers specially female flowers indicating the plant potential in organizing more numbers of fruit and as a result, leads to a higher yield of plant. Therefore, is expected to produce more

Pericarp parts, which is utilizable and saleable. According to figure 1, it is expected to (774 g/m̀ ).

As the Jahan, M. 2008 reported corn inoculation with Azotobacter and Azospirillium leads to an increase in photosynthesis rate and N increase in water and nutrients absorption and as a result causes an increase in maize" (fruit) yield.

On the basis of existed results and considering Nitropositive state of such Pumpkin, it seems that the biological fixation ability of utilized bacteriae are less than this plant's Nitrogen need and therefore,by using mineral N, we can observe and increase in seed production in treatments 8, 9, 10, 11 and 12. Also, by comparing Nitroxine effect against Nitrajine, we conclude that Nitroxine, yielded more results than Nitrajine and perhaps this events as a result of adaptability of existed bacteriae in Nitroxine fertilizer, which are more active in Rhyzosphere area of Pumpkin. About dry weight of seed, it is discovered that the least dry weight of seed relates to treatment 1 and 2 (59/92 and 88 g/m2) and the highest weight was of treatment 8,9,10,11 and 12 (268.6, 258.4, 268.5, 260.9 and 250 g/m2 ).

Yahalom *et al.* (1984), claimed that inoculating peas with Azospirillum causes a significant increase in seed yield.

- Consuming blank fertilizer have an antagonist effect with Nitrajine, because there is a decrease when using Nitroxine alone.
- Nitroxine + Nitrajine produces a higher yield comparing to the utilization of each biological fertilizer alone and existed bacteriae in these 2 fertilizers fortify and complete the nitrogen fixation.
- Nitroxine + Nitrajine + 70% Urea fertilizer showed a significant decrease in yield and this may be caused by applying additional fertilizer or the bad effect of additional fertilizer on bacteria yield or producing poisoning condition in this treatment.

The highest ratio of kernel to testa was reached in treatment 12(8.3%) and the least ratio was achieved in treatment 1(4.1%) (Figure 4).

If this ratio is high, it means the pericarp is thin and major parts of the seed weight are occupied by kernel. For this reason, this treatment has the highest percentage of oil and it has a significant in demand in nut consumption. As a result, increasing the accessability to nitrogen sources and following that more assimilate transportation into Grains, leads to filling and loading of kernels.

The highest oil yield relates to treatments 12, respectively (240 %) and the least yield rate relates to treatments 1, respectively (32.35 %) (Fig. 5).

The highest amount of harvest index relates to treatment 9 (27%) and the least amount of harvest index relates to treatment 3, 4, 6 and 12 respectively (13.9,13.5 12 and 15.67 %).

Table 2: Analysis of variance on quantitative characteristic of Pumpkin in different bio fertilizer treatment

| | | Mean squares | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| S.O.V | d.f. | Number of flowers | Fruit weight | Grain yield | Number of seeds per fruit | Hollow percentage | Ratio of kernel to testa | Oil percentage | Oil Yield | Harvest Index |
| Blocks | 2 | 91.45 | 4271802.80 | 16678.15 | 18750.33 | 74.38 | 1.89 | 0.29 | 16636.52 | 193.63 |
| Treatment | 11 | 63.64* | 4782681.67** | 161987.65** | 4109.65 | 38.78 | 2.34* | 0.07 | 10060.06** | 159.11** |
| Error | 22 | 25.37 | 1290347.23 | 7003.40 | 9058.80 | 29.34 | 0.23 | 0.10 | 14282.14 | 44.22 |
| C.V (%) | | 38.93 | 37.70 | 31.08 | 40.73 | 72.74 | 8.84 | 48 | 63.75 | 35.21 |

*&** Significant at 5 and 1% levels, respectively.

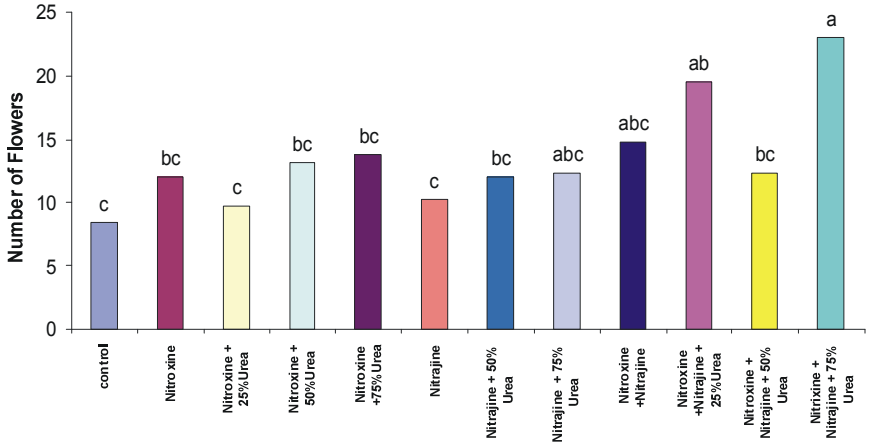


Fig. 1: Comparing number of flowers in different fertilizer treatments.

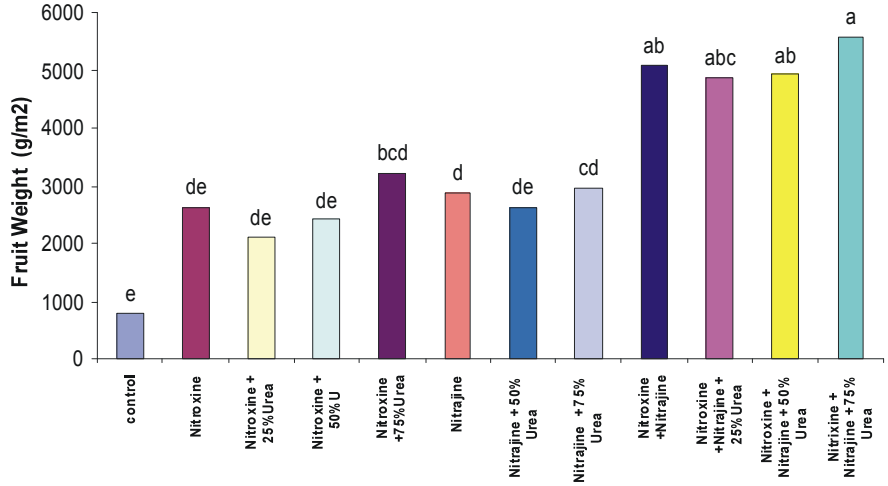


Fig. 2: Comparing mean fruit weight in different fertilizer treatments.

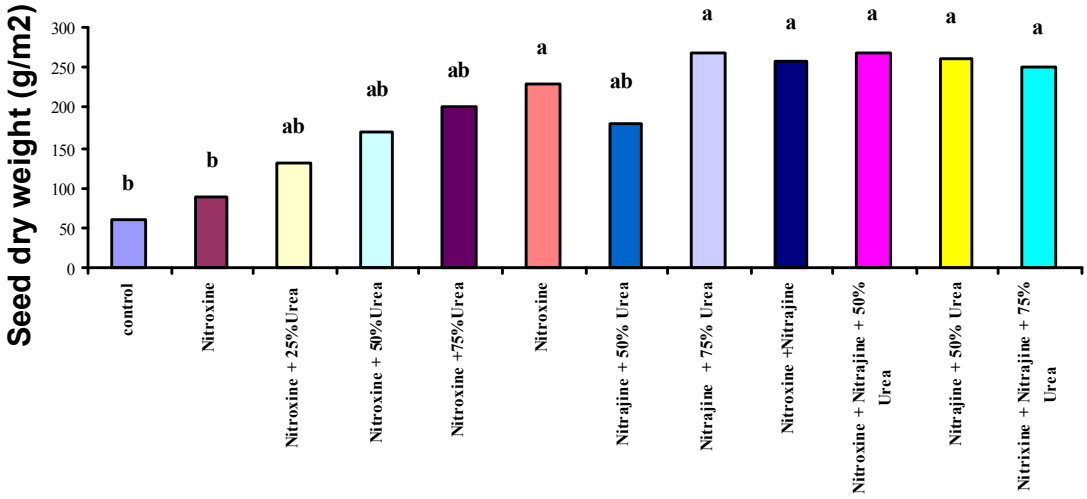


Fig. 3: Comparing mean seed dry weight in different fertilizer treatment.

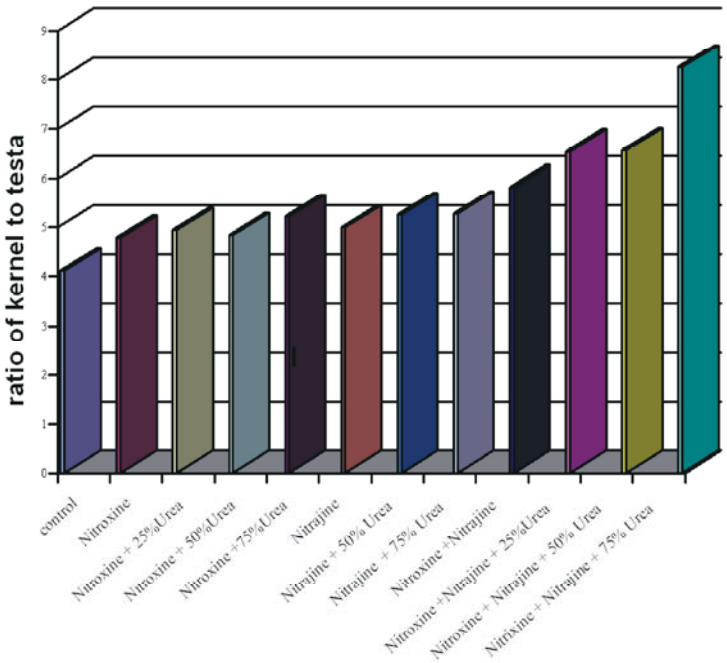


Fig. 4: Comparing mean ratio of kernel to testa in different fertilizer treatment.

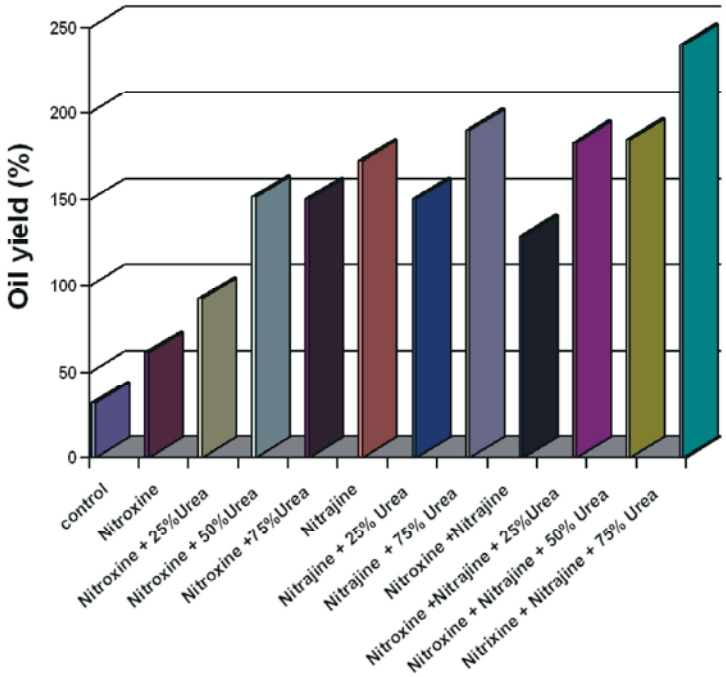


Fig. 5: Comparing mean oil yield in different fertilizer treatment.

The amount of fixed nitrogen in biological fertilizer treatment seems sufficient in maximizing harvest index and it has a decreasing effect on harvest index by adding a blank fertilizer. Little biological yield in blank treatment leads to a rise in harvest index.

Aghaee Okhchelar *et al*. 2010. claimed that utilization of biological fertilizer leads to an increase in harvest index of seed yield in Pumpkin. Data mean showed that applicatory fertilizer treatment in level 5% of seed number in fruit and hollow percentage has no significant effect.

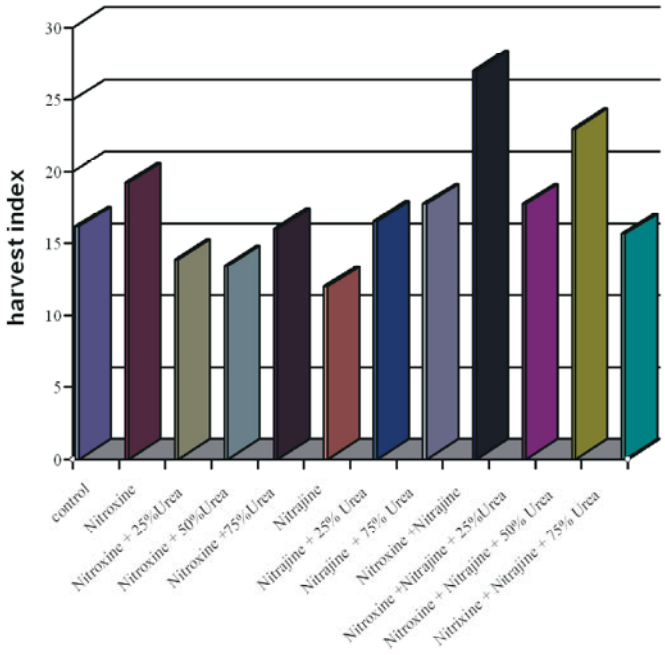


Fig. 6: Comparing mean harvest index in different fertilizer treatments.

## CONCLUSIONS

Seed yield in treatment Nitroxine + Nitrajine + 50% Urea reached its highest amount. Despite, there is no significant difference in Nitroxine + Nitrajine treatment. On the other hand, seed oil percentage was not affected by fertilizer treatment. According to information stated above, it seems that the best treatment to produce Pumpkin in Khoy condition is the combined utilization of Nitroxine+Nitrajine as a biological fertilizer which has no destroying environmental effects, in addition to an increase in crop production and they are all aim to reach a sustainable agriculture.

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