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# EFFECTS OF NUTRITION AND POTASSIUM ON VEGETATIVE CHARACTERISTICS AND YIELD OF POTATO

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**ABSTRACT**
Nitrogen (N) fertilizer management is a challenge in potato production. Also Potassium(K) fertilizer often required for optimum potato yields Therefore, a study was carried out on the effect of different nitrogen and Solupotasse fertilizer levels on vegetative characteristics and yield in 2014. It was a split plot experiment based on a Randomized Complete Block Design with three replications. The main plot was four N fertilizer levels (0, 125,250 and 375 kg N/ha) and the sub-plot was four K fertilizer levels (0, 2,4 and 6 kg K/ha). The results showed that the main effect of N fertilizer was significant on mean leaf number, mean plant height, mean tuber number and fresh tuber yield at 1% probability level and the main effect of N fertilizer was significant on Mean branch number at 5% probability level. Also, the main effect of K fertilizer was significant on mean tuber number, and fresh tuber yield at 1% probability level. The interaction effect was significant on mean tuber number, and fresh tuber yield at 1% probability level. Means comparison showed that the application of 375 kg N/ha had a significant effect on measured traits and ranked in the superior group. Also application of 0 kg/ha solupotasse was ranked in the superior group. In terms of tuber number per plant, application of N fertilizer 375 kg/ha and K fertilizer 4 kg/ha ranked in the superior group. In terms of fresh tuber yield, application of N fertilizer 375 kg/ha and K fertilizer 0 kg/ha ranked in the superior group.

**KEYWORDS:**Nitrogen , Solupotasse, Potato, Yield, Vegetative traits.

## INTRODUCTION

Potato (*Solanom tuberosum* L.) is classified as tuber crops which has important impact on human feeding and in terms of high yield per unit area, energy content and produced protein, is superior to wheat and rice (khajehpour, 2006). The rate of nitrogen fertilizers used in potato production is an important environmental concern (mayer, 2002). Nitrogen is an essential element for plant growth and is a main part of proteins. When plant grows up in unfavorable environmental conditions, protein production is reduced and nitrogen accumulates as non-protein compounds. Sufficient use of nitrogen fertilizers in early growth season will expand leaf area and increase photo assimilates. Deficiency of nitrogen will decrease tuber yield via affecting the tuber production (Molerhagen, 1993). Prosba (1993) reported also that increase in nitrogen fertilizer raised mean weight of tubers.

Potato has a relatively high requirement for K. Fertilizer recommendations for K in potato production are quite high. The amount of K needed by the potato plant is directly proportional to tuber yield (Roberts and Beaton, 1988). Insufficient K can result in reduced yields and tuber sizes (McDole *et al.*,1978). Belanger *et al.* (2000) reported that estimation of optimum fertilizer rates is of interest because of growing economic and environmental concerns. Nutrient management is a controllable input that potato growers utilize to ensure high tuber yields and quality. Both N and K fertilization are often required for maximum production. Optimum recommendations can only be made if the specific effects of K-sources and their interaction with N rates are known. This study was conducted to evaluate relationship of nitrogen and solupotasse amount and vegetative traits and yield in Agria cultivar and also to find the most appropriate quantity of nitrogen and solupottase to produce a healthy crop in Iran.

## MATERIALS AND METHODS

The study area is located Jolge Rokh, Khorasan Razavi , Iran with longitude of 30°17' and latitude of 56°57' in 2013 – 2014. Annual average temperature in research area was 15.6° C and average rainfall was 260 mm and also it was 985 m higher than sea level. A split-plot field design with four replication in a randomised block design was employed. Main plot provided four levels of nitrogen fertilization ( 0, 125, 250, 375 kg per ha) . Each Main plot was subdivided into two levels of solupotasse fertilization (0, 2, 4, 6 kg per ha) . Solupotasse solution was sprayed in three stages. Phosphate

  

application remained constant for each level of solupotasse. Whole amount of phosphate and third of the urea at the time of preparing seed bed was used. Seed cultivation with density 12.5 plants per $m^2$ at May, was done, plants distance on rows were 20 cm. Rows were spaced 40 cm and plots contained 5 rows each 3 meters. Control of weed was done through mechanical and in two times manually. Three plants selected randomly, then plants were transferred to the laboratory. This experiment measured properties such as plant height, number of branch, number of tubers per plant, number of leafs, leaf chlorophyll content and tubers yield per unit. Leaf chlorophyll content measured using chlorophyll meter device (model: SPAD-502) were calculated. Results were analyzed by SAS software, mean comparisons were done via Duncan's multiple range test and graphs were drawn by Excel software.

Table 1 : Soil characteristics examined at the depth of 0 – 30 cm.

| Texture | pH | Ec ds/m | TNV % | O.C % | Sand % | Silt % | Clay % | P (mg/kg) | K (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|
| Sandy Silt | 7.9 | 1.78 | 17.6 | 0.56 | 41 | 35 | 24 | 12.0 | **213** |

## RESULTS AND DISCUSSION

Mean Plant Height:

Analysis of variance (Table 2) showed that the main effect of N fertilizer was significant on mean plant height at 1% probability level. The main effect of K fertilizer and N fertilizer × k fertilizer on mean plant height was not significant. Also, means comparison table (Table 3) showed that all four K fertilize levels had no significant differences in their mean plant height and were ranked in same group. Among N fertilizer levels, application of 375 kg N/ha gave rise to the greatest mean plant height. The results were in agreement with Jafari and Heidari (2014) who reported that the effect of different N fertilizer level was significant on plant height.

**Table 2: Analysis of variance of effect of N and K fertilizer levels on different traits of potato.**

| Sourcess of variance | df | Mean plant height | Mean plant height | Mean tuber number | Mean leaf number | Leaf chlorophyll content | Fresh tuber yield |
|---|---|---|---|---|---|---|---|
| **Replication** | 2 | 3.0 | 3.0 | 0.8 | 1.3 | 26.0 | 13.7* |
| **N Fertilizer** | 3 | 449.3** | 449.3** | 295.8** | 48.5** | 189.1 | 2305.3** |
| **R*N** | 6 | 1.3 | 1.3 | 14.7 | 0.7 | 135.2 | 2.1 |
| **K Fertilizer** | 3 | 0.1 | 0.1 | 5.5* | 1.0 | 63.0 | 29.5** |
| **N*K** | 9 | 1.3 | 1.3 | 7.1** | 0.5 | 79.0 | 13.6** |
| **R*N*K** | 24 | 0.8 | 0.8 | 1.6 | 0.5 | 34.6 | 0.5 |

* and ** show significance at 5% and 1% probability level.

**Table 3: Means comparison of effect of different N and K fertilizer levels on different traits of potato.**

| | Mean plant height (cm) | Mean branch number / plant | Mean tuber number / plant | Men leaf number / plant | Leaf chlorophyll content | Fresh tuber yield (t/ha) |
|---|---|---|---|---|---|---|
| **N fertilizer levels** | | | | | | |
| **0 kg/ha** | 50.7 d | 5.7 a | 17.0 b | 11 b | 40.8 a | 19.9 d |
| **125 kg/ha** | 53.6 c | 5.9 a | 17.2 ab | 10.8 b | 45.3 a | 26.0 c |
| **250 kg/ha** | 60.5 b | 7.9 a | 24 a | 12 b | 45.1 a | 41.8 b |
| **375 kg/ha** | 64.0 a | 7.8 a | 27 a | 15.1 a | 49.9 a | 49.9 a |
| **K fertilizer level** | | | | | | |
| **0 kg/ha** | 57.1 a | 6.8 a | 20.8 a | 11.9 a | 46.8 a | 36.4 a |
| **2 kg/ha** | 57.4 a | 6.8 a | 21.8 a | 12.5 a | 43.4 a | 34.4 b |
| **4 kg/ha** | 57.2 a | 7.1 a | 22 a | 12.0 a | 44.5 a | 32.5 c |
| **6 kg/ha** | 57.1 a | 6.5 a | 20.6 a | 12.5 a | 46.3 a | 34.2 b |

  

Mean Branch Number/plant:
Analysis of variance (Table 2) showed that the main effect of N fertilizer was significant on mean branch number at 5% probability level. The main effect of K fertilizer and N fertilizer × k fertilizer on branch number was not significant. Also, means comparison table (Table 3) showed that all four K fertilize levels had no significant differences in their branch number and were ranked in same group. Among N fertilizer levels , application of 375 kg N/ha gave rise to the greatest leaf number. The results were in agreement with taghdiri and sepehri(2010) who reported that the effect of different N fertilizer level was significant on leaf number.

Mean Tuber Number/plant:
The main effect of N fertilizer levels on mean tuber number/plant was significant at 1% probability level (Table 2). The main effect of K fertilizer was significant at 5% probability level (Table 1). Also N fertilizer × K fertilizer interaction was significant at 1% probability level (Table 1). Also, means comparison table (Table 3) showed that among different N fertilizer levels, application of 125 kg N/ha was lower than the other three levels and other levels was ranked in the superior group. But all four K levels had no significant differences in their mean tuber number/plant and were ranked in same group. In N fertilizer ×K fertilizer interactions, application of 375 kg N/ha was better than the other levels at K level of 4 kg/ha and were ranked in superior group a. This is in agreement with foregoing researches (Aghighi et al, 2011;Saeedi, 2007; Koochaki, 2006).

Mean Leaf Number/plant:
Analysis of variance (Table 2) showed that the main effect of N fertilizer was significant on mean leaf number at 1% probability level. The main effect of K fertilizer and N fertilizer × k fertilizer on leaf number was not significant. Also, means comparison table (Table 3) showed that all four K fertilize levels had no significant differences in their leaf number and were ranked in same group. Among N fertilizer levels, application of 375 kg N/ha gave rise to the greatest leaf number. The results were not in agreement with Vos (1995) who reported that the effect of different N fertilizer level was significant on Branch number and declined with increase in nitrogen supply.

Leaf chlorophyll content:
Analysis of variance (Table 2) showed that the main effect of N fertilizer, K fertilizer and N fertilizer × K fertilizer on leaf chlorophyll content was not significant. Also, means comparison table (Table 3) showed that all fertilizer levels had no significant differences in their mean leaf chlorophyll content and were ranked in same group. The results were not in agreement with Arshadi et al. (2012) who reported that the effect of different N fertilizer level was significant on leaf chlorophyll content

Fresh Tuber Yield:
Analysis of variance (Table 2) showed that the main effect of N fertilizer , K fertilizer and N fertilizer × K fertilizer interaction was significant on fresh tuber yield at 1% probability level. Among N fertilizer levels, the fertilizer level of 375 kg had the strongest effect on fresh tuber yield and produced the highest yield. Also among K fertilizer levels, the fertilizer level of 0 kg had the strongest effect on fresh tuber yield and produced the highest yield. Among the interactions too, N fertilizer level of 375 kg/ha at K fertilizer level of 100 kg /ha ranked in the superior group and no-fertilizer level ranked in the inferior group. The increase in the application of N fertilizer up to a certain level increases the potato yield, but since then, it has no effect on the increase in yield (Westerman et al., 1985). Jindong et al. (2006) stated that if the amount of applied fertilizer is greater than field capacity, the excessive fertilizer leaches to underground waters, which is harmful to ecosystems. Therefore, the recommendation regarding fertilizer type and level for a crop and field must be based upon genuine and delicate experiments. But This research was in agreement with Lie et al. (2003) who reported that high levels of fertilizer maximizes the net efficiency by neutralizing the adverse effects of soil quality on yield.

  

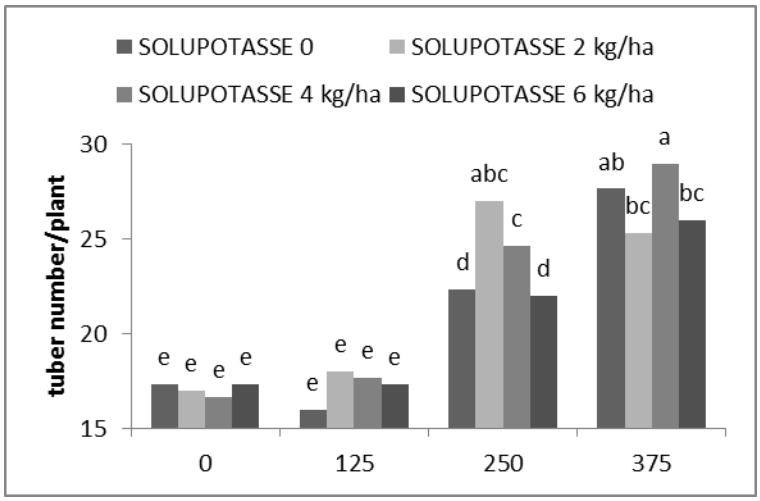


**Fig. 1: Interaction between different N fertilizer levels and different K fertilizer on tuber number/plant.**

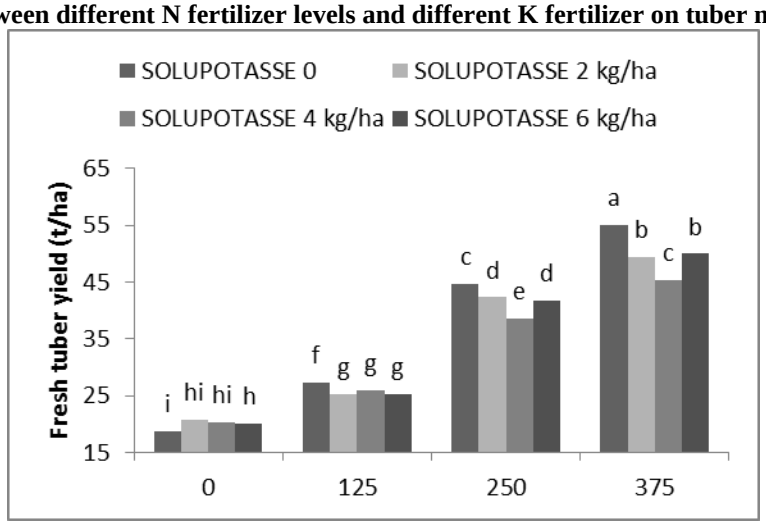


**Fig. 2: Interaction between different N fertilizer levels and different K fertilizer on fresh tuber yield.**

## CONCLUSION

Generally it can be said that yield has the highest values at the level of 375 kg ha-1 and increase in nitrogen amount caused highest values in many traits. Also yield has highest value at the level of 0 kg ha-1 sulopotasse. So, application of 375 kg ha-1 Nitrogen along with 0 kg ha-1 sulopotasse in order to gain the highest tuber yield recommended for this cultivar in Mashhad region.

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