ISSN 2349-7823

International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 5, Issue 2, pp: (46-50), Month: April - June 2018, Available at: www.paperpublications.org

EFFECT OF NITROGEN AND POTASSIUM ON GROWTH AND YIELD ATTRIBUTES OF KUFRI CHIPSONA-3

[1]Veerpal Kaur, [2]Kanwaljeet Singh, [3]Baljinder Singh

*Khalsa College, Amritsar (143002)
[3]Assistant Professor Agronomy, University College of Agriculture, Guru Kashi University
*Email of corresponding authors: kaurveerpal1990@gmail.com

Abstract: **The experiment was conducted at the Student's Research Farm, Khalsa College, Amritsar during Rabi season 2013. The soil of experimental field was categorized as sandy loam. The soil tested low in organic carbon and available nitrogen (N) but high in available phosphorus (P) and potassium (K). The soil pH and electrical conductivity values were within the normal range. The experiment was laid out in a randomized block design (RBD) having 10 treatments comprising three levels of N (100,125 and 150 kg/ha) along with three levels of K (100, 125 and 150 kg K_2O/ ha) and one control. All the fertilizer treatments gave higher growth, yield, net returns and B: C ratio as compared to control. Among different treatments of fertilizer, treatment T_6 ($N_{125\%}$ + $K_{125\%}$) recorded maximum total tuber yield (454.5 q/ha) and net returns (166144.01 Rs/ha).**

Keywords: **Nitrogen, Potassium, Growth, Yield, Kufri Chipsona-3.**

1. INTRODUCTION

Potato is one of the important food crops of the world which is grown on all continents, in around 130 countries in the world, now mainly potato growing countries are Poland, USA, China and India. Potato is the fourth most important food crop after rice, wheat and maize in the Eastern Plains of India (Singh et al 2008). It can supplement the food need of the country in a substantial way as it produces more dry matter food, has well balanced protein and produces more calories from per unit area and time than other major food crops. Potatoes are an economical food; they provide a source of starch, vitamins especially B1, B2, B6 and C. They contain 20.6 per cent carbohydrates, 2.1 per cent protein, 0.3 per cent fat, 1.1 per cent crude fiber and 0.9 per cent ash (Chhidda *et al*., 2003). It is used as vegetable, stock feed and in industries for manufacturing starch, alcoholic, beverages and other processed products *i.e*., chips, French fries *etc*. India produced 45.34 million tonnes (Anonymous, 2012) tubers annually. Major potato growing states are U.P., Bihar, Karnataka and Punjab. In Punjab, potato is cultivated in an area of 85.25 thousand hectares and huge quantities of 2.13 million tonnes (Anonymous, 2012) tubers are being produced which contributes 4.28 per cent in the total production of the country. Mostly sowing starts in the state in the state from 1st week of October continue till November.

Balanced fertilization has proved to be a king pin in agricultural production under different farming situation and contributed to nearly 50 percent in overall increase in agricultural production (Singh *et al*., 2008). The potato crop requires balanced dose of nitrogen (N), phosphorous (P) and potassium (K) for optimum production (Singh et. al and Trehan et al., 1998). In Punjab, for establishment of table varieties of potato, recommendation of N, P and K is standardized *i.e*., 185.2 N, 61.7 P_2O_5 and 61.7K_2O kg/ha (Anonymous, 2012). Nitrogen and potassium has positive effects on tuber crop. A better understanding of N-K interaction can be useful guide to best nutrient management practices in potato crop in order to achieve high yields with high nutrient use efficiency. Keeping above facts in view a field trial was conducted to find suitable dose of potassium for potato cultivar Kufri Chipsona -3 for optimum yield under different nitrogen levels.

2. MATERIALS AND METHODS

The present investigation was carried out at the Student's Research Farm, Khalsa College, Amritsar during season 2013-14. Amritsar is located at 31^0-38" North latitude, 72^0-52" East longitude at an altitude of 236 meters above mean sea level. This part is characterized by semi humid climate, where both winter and summers are extreme. A maximum temperature of about 45-48^{0}C is common during summer while during December and January temperature may be near freezing points accompanied by frost. The soil of experimental field was categorized as sandy loam. The soil tested low in organic carbon and available nitrogen (N). However, available phosphorus (P) and potassium (K) status were high. The soil pH and electrical conductivity values were within the normal range. The experiment was laid out in a randomized block design (RBD) having 10 treatments comprising three levels of N (100,125 and 150 kg/ha) along with three levels of K (100, 125 and 150 kg K_2O/ ha) and one control.

N and K doses vary according to treatments, but dose of P was as per recommendation for all the treatments. Full P & K and half of N were applied at the time of planting and rest half N was top dressed at the time of earthing up at 25 days after planting. The sources of N, P & K were Urea, Single Super Phosphate and Murate of Potash, respectively. Well-sprouted tubers of potato Cv. Kufri Pukhraj of seed size 50-60 g were planted during first week of November. Tubers were covered with 10-12 cm soil layer. The potato crop was dehaulmed at 90 days after planting during first week of February and harvested 10-12 days after dehaulming. Rest of the agronomic package of practices adopted was as per recommendation for potato cultivation. During the growth period, plant emergence percentage, plant height, number of leaves/plant, number of stems/hill were recorded at 30 days after planting (DAP), Leaf Area Index (LAI) was measured with Accuse PAR LAI Cepto-meter LP-80 and chlorophyll content was determined with Chlorophyll Meter (SPAD- 502) at 45 and 60 days after planting (DAP). Yield parameters, aggregate and grade wise tuber yield and tuber population of four grades namely very small (<25 gm), small (25-50g) medium (50-75gm), large (>75 gm) size tubers, were recorded separately at harvest. The N, P and K content of tuber and haulm of potato was determined by modified micro Kjeldahl, Vando-molybdate spectrophotometer and flame photometer methods respectively as described by Singh *et al*. (2005). The cost of cultivation was calculated by taking into account the prevailing market price of inputs and the produce. Benefit: cost ratio (B: C ratio) was expressed as gross return per rupee spent. Price of different commodities taken for economics of potato production are, potato seed -Rs 10000/t, N- Rs 10.92/kg, P_2O_5- Rs 21.60/kg, K_2O- Rs 7.72/kg, Potato- Rs 4000/t and other cultivation charge- Rs 35000/ha. Medium sized potato tuber weighing 5 kg was stored at ambient temperature for 90 days for keeping quality assessment. The produce of experiment was kept for storage studies after 15-20 days of curing in heaps after the harvest. The average maximum and minimum temperature during the period of storage was 39.6°C and 31.8°C and the relative humidity was 67%.

3. RESULTS AND DISCUSSION

Growth:

A good and uniform emergence is the basic requirement for good establishment that is required for the successful raising of any crop, which ultimately determines the crop yield. Taking in view the dominant role of the plant emergence, observations on this parameter were recorded in different treatments. The data in table 1 reveals that emergence was not influenced significantly due to different treatments. It means that there was almost similar level of plant population in all the treatments. This may be due to the fact that growing tubers get their food from the mother tuber. All the treatments were found non-significant. It was also observed that control plot (without any fertilizer) took maximum days for 100% emergence as compared to other treatments. Kumar *et al* (2004) reported that the plant emergence was not significantly affected due to N application. Tuber initiation is an important factor from yield point of view. Early tuber initiation indicates more time for tuber growth and hence more yield. The effect of different treatments on tuber initiation was studied and presented in Table 1 and showed that all the treatments were non-significant and at par with each other. Early tuber initiation was recorded in treatment T_6 and slightly late tuber initiation was recorded in control. It means that there was almost equal time taken for tuber initiation in all the treatments.

Number of stems per hill is an index of growth and adaptability of the plant to the soil and climatic condition. It is the most important parameter which has a direct bearing on development of tubers and tuber yield. The data recorded on the number of stems per hill (60 days) are given in table and diagram 1, which revealed that all the treatments produced significantly more number of stems per hill than control. Number of stems increased with increase in fertilizer dose upto treatments T_6; thereafter a decreasing trend was noticed upto T_{10}. All the treatment had significant differences with each other except T_2, T_3 and T_{10}; T_3, T_4 and T_9; T_4, T_5 and T_7. Maximum number of stems under treatment T_6 may be due to

better availability of nutrients. Zamil *et al.* (2010) observed that the highest number of stems per hill (4.43) was obtained when the highest rate of nitrogen (254 kg/ha) was applied and the lowest (2.70) was found in the control.

Plant height is a reliable index of growth and development of plant. A taller plant usually support more number of shoots and leaves and hence more plant food is manufactured which results in more yield of crop. The perusal of the data depicted in the table 1 reveals that increase plant height in all the treatments. Plant height increased with increase in fertilizer dose. All the treatments were showed significantly taller plant than control. Maximum plant height was observed under treatment T_{10}. Rate of increase from T_2 to T_{10} was significant. Treatments viz. T_6, T_7, T_8, T_9 and T_{10} being at par with each other but, differed significantly from T_2, T_3 and T_4. T_5 having intermediate value was found at par with all other treatments except with T_2, T_{10} and control. The results are further supported by Rajanna *et al.* (1987) who stated that application of N up to 240 kg/ha significantly increase the plant height.

Leaf area index (LAI) is an important plant growth attributes determining the capacity of plant in trapping solar energy for photosynthesis and has marked influence on growth and yield of crop. The assimilating capacity of a crop depends upon the development and maintenance of optimum LAI. LAI below optimum results in lesser interception of solar radiation and hence lesser production. If LAI is above the optimum limits, there is mutual shading of leaves, causing lower leaves to be parasitic. The data regarding LAI at 60 DAS as affected by various treatments are represented in table and diagram 1 reveals that all the fertilizer treatments gave significantly more LAI than control. T_{10} being at par with T_9 showed significantly highest LAI than all other treatments (T_2, T_3, T_4, T_5, T_6, T_7, T_8 and control). However treatment T_8 with T_9, T_7 with T_8, $T_6$with T_7, T_5 with T_6, T_4 with T_5 and T_6, T_3 with T_4 and T_5, T_2 with T_3 were statistically at par with each other. Higher LAI at higher fertilizer dose might be due better growth of above ground foliage. Similar result of Hossian *et al.* (1995) found that application of nitrogen enhanced leaf length from 10.3cm to 22.8cm.

Yield and Economics:

The data on the effect of different fertilizer treatment on total tuber yield of potato are, therefore, presented in table 2. Treatment T_6 (454.5q/ha) being at par with T_8 (451.2q/ha) produced significantly more total tuber yield than T_1, T_2, T_3, T_4, T_5, T_7, T_9 and T_{10}. However T_2 with T_3, T_4 with T_5, T_7 with both T_9 and T_{10} were statistically at par. The per cent increase in yield in all the treatments over control was found to be 113.8, 121.8, 130.5, 131.3, 154.9, 136.6, 153.0, 141.2 and 141.8 in T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 and $T_{10,}$ respectively. Increase in total tuber yield upto T_6 (454.5q/ha) could be attributed to the toxicity due to higher concentration of Nitrogen and Potassium. Rajanna *et al.* (1987) also reported application of different levels of N increase the tuber yield significantly over control. Barghi *et al.* (2012) also reported similar result.

Data in table and diagram 2 depicts that treatment T_6 gave maximum returns (166144.01 Rs/ha) followed by T_8 (162370.92 Rs/ha) and T_{10} (151526.26 Rs/ha). Whereas treatment T_1 was recorded minimum returns (27972Rs/ha). Also it was conducted that the combination of nutrients i.e. treatment T_6 gives maximum tuber yield. So, the treatment T_6 gave maximum B:C ratio (3.71). Data evaluate that treatment T_6 gave better result in economics of potato crop.

4. CONCLUSION

All the fertilizer treatments recorded higher growth, yield, net returns and B:C as compared to control. It was concluded that application of N @ 231.5 kg/ha along with K @ 77.2 kg/ha recorded maximum total tuber yield and net returns.

ACKNOWLEDGEMENT

The authors are grateful to Khalsa College, Amritsar for providing the field facility.

REFERENCES

[1] Anonymous (2012).*Package of practice for cultivation of vegetables*. Punjab Agriculture University, Ludhiana. 89 - 99.

[2] Barghi, Ali; Tobeh, Ahmad and Hassanzadeh, Nasim (2012). Effect of nitrogen fertilizer levels on tuber filling rate and protein assimilation in early and late maturing potato. *Annals of Biological Research*, **3**(9): 4264 – 4275.

[3] Gomez, (1984). Effect of potassium on potato yield, quality and nutrient use Potato J 39 (2): 157

[4] Hossian, M.J., Elias, M. and Habib, A. K.M.A., Akhtaruzzaman M.A. and Islam, M.S. (1995). N- requirement for raising cut – shoot – potato crop. *Journal of Indian Potato Association*, **22**(1-2): 52-55.

[5] Kumar, P; S.K., Pandey, B.P. Singh, S. Rawal, S.V. Singh and Dinesh Kumar (2004). Fertilizer requirements of chipping Potato cv. in west – central Plains. *Potato J.* **31**(3-4): 177-181.

[6] Rajanna, K.M., Shivasankar, K.T. and Krishnappa, K.S. (1987). Effect of different levels of nitrogen, phosphorus and potassium on growth, yield and quality of potato. *South Indian Horticulture*, **35:5**, 347 – 355.

[7] Singh, Kamla and Grewal, J.S. (1998). Nitrogen and irrigation requirement of potato in alluvial soils of Patna. *Jour. Of Ind. Potato Assoc*.**10**(12): 1-9.

[8] Singh, Chhidda, P. Singh, R. Singh. (2003). Modern techniques of raising field crops 14: 320-325.

[9] Singh, S.K. and Gupta, V.K. (2005). Influence of Farm Yield, Nitrogen and Biofertilizers on growth, Tuber yield of potato under rain – fed condition in East Khasi hill district of Meghalaya. *Agricultural Science Digest*, **25 (**4): 281-283.

[10] Singh, K.P., Singh, R.K., Singh, S.N. and Singh, V.K. (2008). Effect of fertilizer level, seed rate and seed size on yield of potato in Acidic Soils of Manipur. *Potato Journal*. **34**(1-2): 93-94.

[11] Trehan, S.P. and Grewal, J. S. (1998). Response of promising potato hybrid JH 222 to N, P and K fertilizers. *Indian Journal Agricultural Research*, **29** (3): 103 – 108.

[12] Zamil, M.F., Rahman, M.M., Rabbani M.G. and Khatun, T. (2010). Combined effect of nitrogen and plant spacing on the growth and yield of potato with economic performance. *Bangladesh Research Publications Journal* **3**(3): 1062-1070.

APPENDIX-A

Table 1: Effect of Nitrogen and Potassium on growth attributes and yield of Kufri chipsona-3

Treatment	Days taken to emergence (100%)	Days taken to tuber initiation	Number of stems/ hill	Plant height (cm)	Leaf Area Index (at 60 days)	Total tuber yield (q/ha)
T_1 – Control	14.01	25.00	5.18	25.2	1.22	178.3
T_2- $N_{100\%}$+$K_{100\%}$	13.50	25.15	7.06	37.0	2.41	383.3
T_3- $N_{100\%}$ + $K_{125\%}$	13.03	25.20	7.50	40.5	2.55	395.6
T_4- $N_{100\%}$+$K_{150\%}$	13.05	25.10	7.75	39.9	2.75	410.1
T_5- $N_{125\%}$+$K_{100\%}$	13.00	25.30	8.06	42.9	2.87	412.5
T_6- $N_{125\%}$ + $K_{125\%}$	12.90	25.80	8.43	44.6	3.05	454.5
T_7- $N_{125\%}$ + $K_{150\%}$	13.25	25.70	8.25	43.5	3.26	422.0
T_8- $N_{150\%}$ + $K_{100\%}$	13.60	25.60	8.40	45.9	3.56	451.2
T_9- $N_{150\%}$ + $K_{125\%}$	13.15	25.40	7.75	45.1	3.75	430.0
T_{10}-$N_{150\%}$ + $K_{150\%}$	13.75	25.50	7.07	46.7	4.01	431.2
C.D. (5%)	NS	NS	0.55	3.32	0.33	16.3

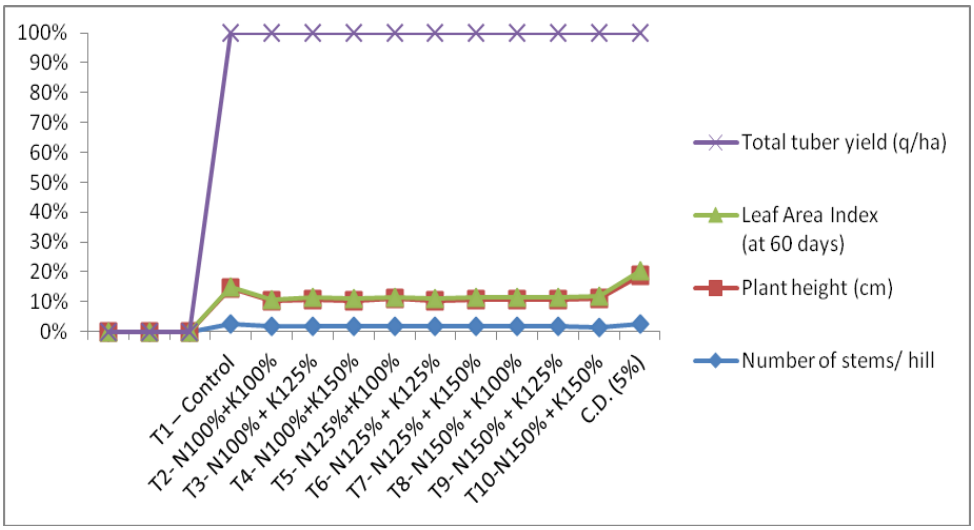

Diagram 1: Effect of Nitrogen and Potassium on growth attributes and yield of Kufri chipsona-3

ISSN 2349-7823

International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 5, Issue 2, pp: (46-50), Month: April - June 2018, Available at: www.paperpublications.org

Table 2: Economic analysis of different fertilizer treatments for potato crop

Treatments	Total cost (Rs/ha)	Total return (Rs/ha)	Net return (Rs/ha)	B.C. Ratio
T_1 – Control	59200.00	87172.00	27972.00	1.47
T_2 -$N_{100\%}$ + $K_{100\%}$	61011.14	191390	130378.86	3.13
T_3 - $N_{100\%}$ + $K_{125\%}$	61181.02	194380	133198.98	3.17
T_4 - $N_{100\%}$ + $K_{150\%}$	61349.80	203930	142580.20	3.32
T_5 - $N_{125\%}$ + $K_{100\%}$	61124.11	202460	141335.89	3.31
T_6 - $N_{125\%}$ + $K_{125\%}$	61293.99	227438	166144.01	3.71
T_7 - $N_{125\%}$ + $K_{150\%}$	61462.77	207972	146509.23	3.38
T_8 - $N_{150\%}$ + $K_{100\%}$	61237.08	223608	162370.92	3.65
T_9 - $N_{150\%}$ + $K_{125\%}$	61406.96	213102	151695.04	3.47
T_{10} -$N_{150\%}$ + $K_{150\%}$	61575.74	213102	151526.26	3.46

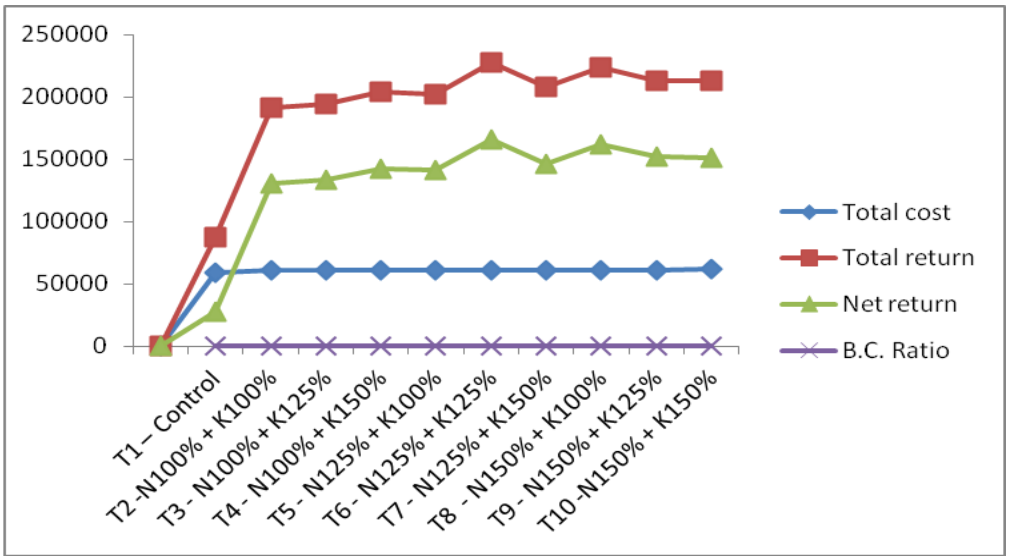

Diagram 2: Economic analysis of different fertilizer treatments for potato crop