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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON THE GROWTH AND YIELD OF POTATO (*Solanum tuberosum* L.) UNDER THE IRRIGATED CONDITIONS OF PUNJAB

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ABSTRACT

The experiment conducted during the Rabi season 2016. The field trial was laid out randomized block design replicated thrice. The treatment considered 13 levels of RDF. Treatments receiving 100% and 75% of N, P, and K, Sulphure @20 kg/ha, $ZnSO_4$ @20 kg/ha with FYM @2t/ha, Vermicompost @1t/ha along with *Azotobacter* seed treatment @3kg/ha significantly higher in plant height, number of branches, fresh weight, dry weight, tuber yield and haulm yield. The results of integrated nutrients for high yield goal had a positive effect on plant height, fresh weight, number of branches and tuber yield. The maximum plant height, fresh weight, number of branches and tuber yield of (188.93 q/ha) was recorded with higher fertilizer level i.e. T_7 T_7 with 100% RDF, Sulphure @20 kg/ha, $ZnSO_4$ @20 kg/ha with FYM @2t/ha, Vermicompost @1t/ha along with *Azotobacter* seed treatment @3kg/ha was significantly at par T_6 (180.22 q/ha) with 100% RDF, Sulphure @20 kg/ha, $ZnSO_4$ @20 kg/ha with FYM @2t/ha, Vermicompost @1t/ha.

Keywords: Potato, INM, Growth, Quality, Yield.

Introduction

Potato (*Solanum tuberosum* L.) is a most important tuber crop of the world, belong to family Solanaceae it is also known as king of tuber crops and poor man's food, the origin place of potato is South America (Peru). It occupies an area of 1.2 m ha in country with a production of 23.5 m tonnes and area of 83.57 thousand hectare in Punjab with a production of 2088.36 thousand metric tonnes. It requires an average temperature of 25^0C for germination, 17 ^{0}C for vegetative growth and 18-20^0C for tuberization. The main potato growing areas in Punjab are Hoshiarpur, Jalandhar, Ludhiana, Amritsar, Kapurthala, Bathinda, Patiala, Fatehgarh Sahib and Moga. Potato is the rich source of starch, vitamin B, C and minerals. It contains about 20.6% carbohydrates, 2.1% proteins, 0.3% fat, 1.1% crude fiber, 18-20% starch content and 1.4% is ash content. Solanin content is 5gm/100 of potato. It is also contain good amount of amino acids like leucine, tryptophan and isoleucine (Khurana and Naik 2003) As no single source is capable of supplying the required amount plant nutrients, integrated use of all sources of plant nutrients is a must to supply balanced nutrition to the crops (Arora 2008).

Materials and Methods

Experiment conducted during the Rabi season of 2015-2016. A field trail consisting of 13 treatment combinations arranging in randomized block design with three replications. The soil of the experimental site was clay in texture with acidic reaction (7.2 pH), and contained organic carbon 0.6%, medium in available nitrogen (376.32 Kg/ha), medium in available phosphorus (30.32 Kg/ha) and high in available potassium (130/kg/ha). All nutrients were applied in basal dose at one day before sowing. The plant material comprised of potato var. Kufri Chipsona-1 as per treatment were sown on 11th October 2015 and harvested at 28 January. The crop was planted maintaining a distance of 45 cm and 20 cm between the row and plants respectively. Five representative sample plants were randomly selected from each of the plots plant heights were recorded in cm. The numbers of branches per plant were counted from the five randomly selected sample plants and the values of these were

summed up and averaged. To study the fresh are dry weight of five plants were collected from the sampling rows of each plot at 30 days interval from sowing till harvest of the crop. The plant samples were then weighted to record the average fresh weight. The produce was separated into 3 grades of tubers and weight and number of tubers were recorded separately for each grade. The tubers of each plot the border and sampling row was weighed in kilo gram and converted into quintal per hectare.

Results and Discussion

Among the important factors, integrated nutrition is one which determines sustained plant growth, development and production of a crop. A use of fertilizer dose 120 kg N/ha (through urea 46%), 80 kg P_2O_5/ha (through single super phosphate 16 % P_2O_5/ha), potash 70 kg K_2O/ha (through muriate of potash 60% k_2O), 20 kg S/ha (through zinc sulphate 35% $ZnSo_4$/ha), 20 kg $ZnSO_4$/ha, FYM 2t/ha and vermicompost 1 t/ha were applied one day before sowing found to be one of most important factor to increase all the growth parameters, yield attributes and yield of crop. INM had affecting the plant height was increased with each increment of the integrated nutrient management. The result of the present study indicates that the application of integrated nutrient management statically significant by increase the plant height at various recorded stages. The highest plant height was recorded in the treatment T_7 (27.33, 45.09, 49.82 and 50.62 cm) where the recommended dose was 100% of NPK, Sulphur @20 kg/ha, $ZnSO_4$ @20 kg/ha with FYM @2t/ha, Vermicompost 1t/ha along with *Azotobacter* seed treatment @3kg/ha. The plant height was rapidly increased significantly with increasing level of integrated nutrient management. The beneficial effect of INM on maximum plant height was also reported by Powon *et al.* (2005), Alam *et al.* (2007), Najm *et al.* (2010), Yourtchi *et al.* (2013 Banjare *et al.* (2014), and Getie *et al.* (2015).

The result of present study found that the number of branch and fresh weight increased significantly with increase in fertilizer combinations with integrated nutrient management. The application of integrated nutrients management with the 100% RDF gave the significantly higher number of branches. The maximum number of branches was also reported by Ali *et al.* (2013), Getie *et al.* (2015) and Amara *et al.* (2015). In general the application of integrated nutrient management increased the fresh and dry weight of plant compared to control treatment. The fresh and dry weight of plant increased significantly with increasing level of integrated nutrient management. The maximum fresh and dry weight of plant was significantly higher in T_7 with 100% RDF, Sulphure @20 kg/ha, $ZnSO_4$ @20 kg/ha with FYM @2t/ha, Vermicompost @1t/ha along with *Azotobacter* seed treatment @3kg/ha of integrated nutrient management. This similar finding was also supported by Powon *et al.* (2005), Sarkar *et al.* (2011), Yourtchi *et al.* (2013), Banjare *et al.* (2014)

Potato tuber yield in kg/plot and q/ha also responded to the application integrated fertilizers. INM outstandingly increased the tuber yield (188.93 q/ha) recorded at the time of harvesting with 100% RDF, Sulphure @20 kg/ha, $ZnSO_4$ @20 kg/ha with FYM @2t/ha, Vermicompost 1t/ha along with *Azotobacter* seed treatment in treatment combination T_7. Treatment T_7 was appreciably increase the maximum tuber yield and commodity value of potatoes. Treatment T_6 was another beneficial treatment followed by T_7. Application of INM therefore provides better nutrition to Potato which resulted in higher tuber yield. This finding was also reported by Khurana (2005), Arora (2008) Mohammadi *et al.* (2013), Singh *et al.* (2014), Chatterjee *et al.* (2014).

Table 1: Effect of INM on plant height (cm) at 30, 60, 90 DAS and at harvesting

Treatment	30 DAS	60 DAS	90 DAS	At harvesting
T_1	16.56	33.15	38.08	39.21
T_2	19.07	36.93	41.83	43.20
T_3	19.57	37.41	43.33	44.89
T_4	21.70	39.67	44.60	45.97
T_5	23.60	40.46	45.33	46.89
T_6	26.20	43.02	47.88	49.22
T_7	27.33	45.09	49.82	50.62
T_8	17.90	33.78	38.55	40.48
T_9	18.77	35.07	39.90	41.27
T_{10}	21.03	36.55	41.35	42.31
T_{11}	21.90	37.80	42.53	43.57
T_{12}	21.53	38.71	43.48	44.48
T_{13}	23.10	40.66	45.56	46.30
Mean	21.40	38.33	43.25	44.49
SE(d)±	2.17	2.11	1.37	2.02
CD (5%)	4.91	4.76	3.09	4.57

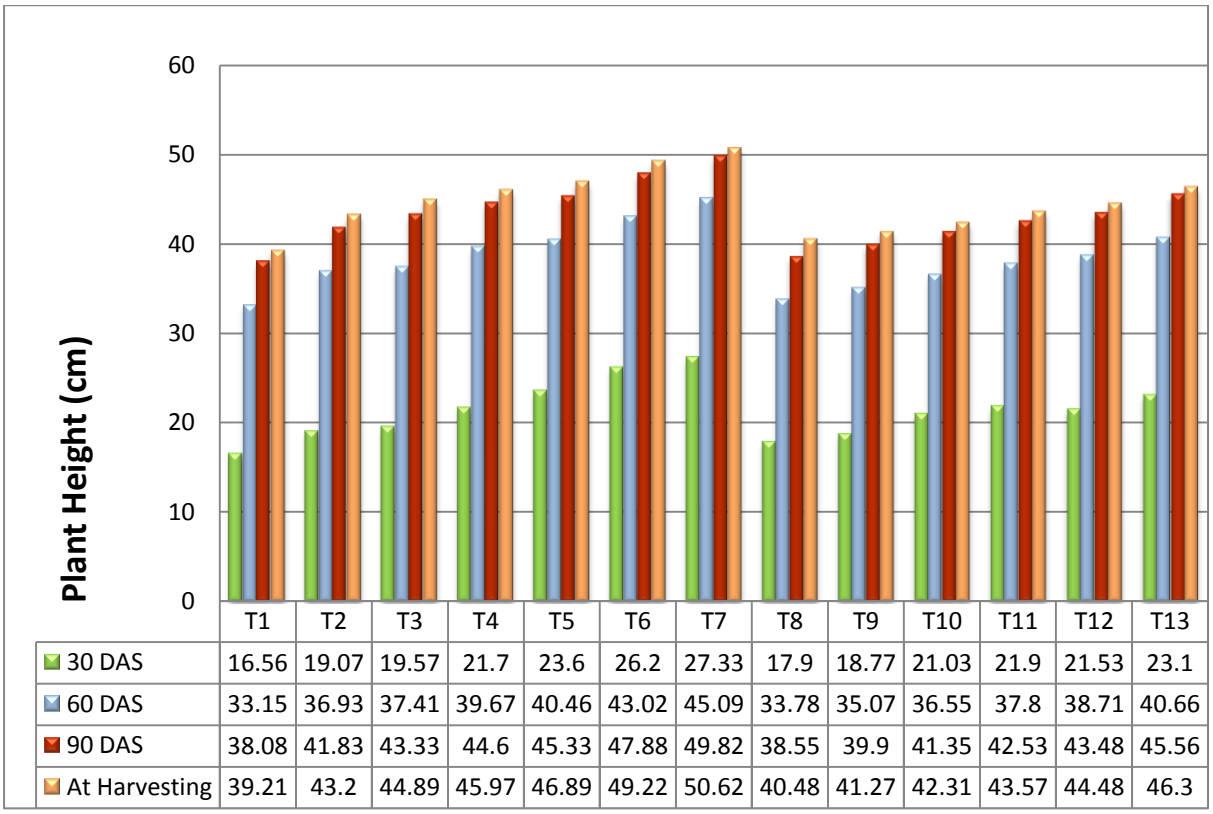

Fig. 1. Effect of INM on plant height in (cm) at 30, 60, 90 DAS and at harvesting

Table 2. Effect of INM on number of branches at 30, 60, 90 DAS and at harvesting.

Treatment	30 DAS	60 DAS	90 DAS	At harvesting
T_1	1.32	3.09	3.44	3.54
T_2	2.33	3.93	4.93	5.13
T_3	2.77	4.52	5.89	6.09
T_4	2.87	5.97	6.94	7.31
T_5	2.93	6.46	7.38	8.28
T_6	3.23	7.15	8.01	9.11
T_7	3.13	7.60	9.33	10.09
T_8	1.63	3.62	4.37	4.94
T_9	2.60	4.40	4.93	5.43
T_{10}	2.35	5.12	5.44	6.54
T_{11}	2.80	5.67	6.84	7.00
T_{12}	2.53	6.33	7.92	8.02
T_{13}	3.13	6.88	8.75	8.91
Mean	2.59	5.44	6.48	6.95
SE(d)±	2.69	1.59	1.64	1.72
CD (5%)	NS	3.59	3.70	3.88

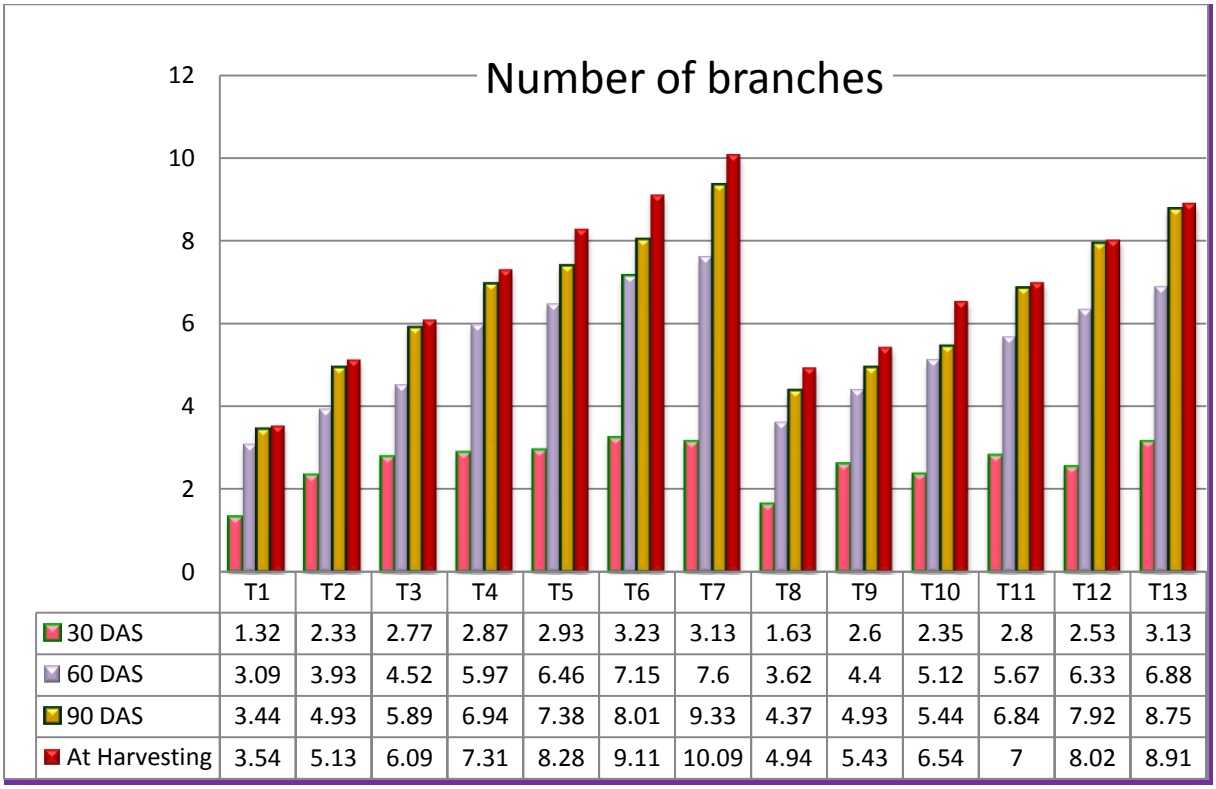

Fig. 2. Effect of INM on number of branches at 30, 60, 90 DAS and at harvesting.

Table 3. Effect of INM on fresh weight of plant (g) at 30, 60, 90 DAS and at harvesting.

Treatment	30 DAS	60 DAS	90 DAS	At harvesting
T_1	10.29	20.66	36.71	38.48
T_2	11.52	23.78	37.45	40.62
T_3	12.24	25.71	37.91	40.71
T_4	13.24	26.06	39.53	42.00
T_5	14.47	27.29	40.26	43.03
T_6	15.18	28.57	41.17	44.01
T_7	16.95	31.29	42.01	44.54
T_8	10.95	21.81	37.92	40.68
T_9	12.06	22.84	38.65	41.48
T_{10}	13.04	23.94	38.97	41.67
T_{11}	14.15	24.55	39.55	42.72
T_{12}	14.84	25.99	40.10	42.94
T_{13}	16.23	27.41	40.86	43.36
Mean	13.47	25.37	39.31	42.02
SE(d)±	1.68	2.12	2.03	1.22
CD (5%)	3.80	4.80	4.60	2.77

Fig. 3. Effect of INM on fresh weight of plant (g) at 30, 60, 90 DAS and at harvesting

Table 4. Effect of INM on tuber yield of potato.

Treatment	kg/plot	q/ha
T_1	11.43	127.09
T_2	13.72	152.52
T_3	14.60	162.26
T_4	14.96	166.28
T_5	15.88	176.51
T_6	16.21	180.22
T_7	17.00	188.93
T_8	13.14	146.00
T_9	13.99	155.51
T_{10}	14.34	159.44
T_{11}	14.76	164.00
T_{12}	15.32	170.28
T_{13}	15.95	177.31
Mean	14.71	163.57
SE(d)±	2.36	1.55
CD (5%)	5.34	3.50

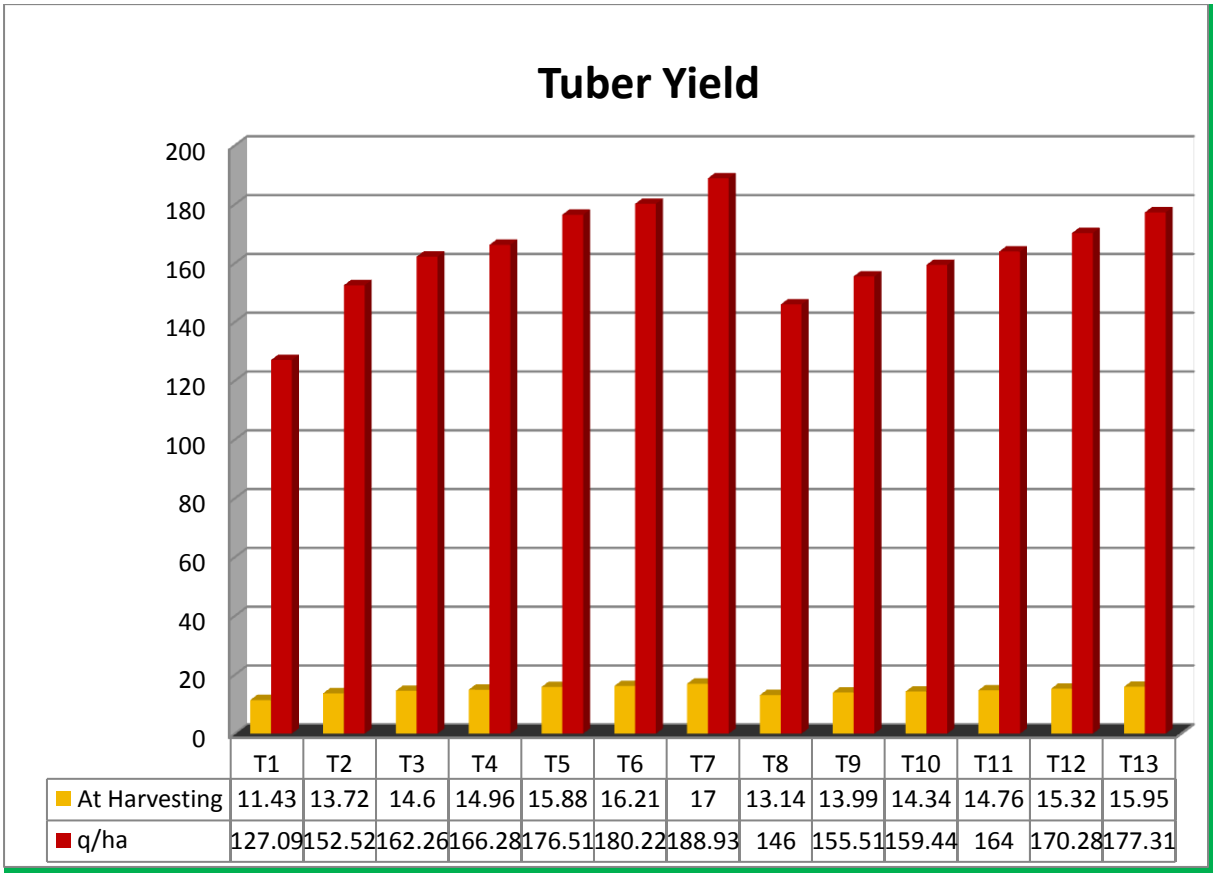

Fig. 4 Effect of INM on tuber yield of potato

Reference

Alam MN, Jahan MS, Ali MK, Ashraf MA and Islam MK (2007). Effect of Vermicompost and chemical fertilizers on growth, yield and yield components of Potato in barind soils of Bangladesh. Journal of Applied Science Research 3(12): 1879-1888.

Arora S (2008). Balanced nutrition for sustainable crop production. *Krishi World (Pulse of Indian Agriculture)*. pp 1-5.

Banjare S, Sharma G and Verma SK (2014). Potato Crop Growth and Yield Response to Different Levels of Nitrogen under Chhattisgarh Plains Agro-climatic Zone. Indian J of Sci. and Tech. **7**(10): 1504–1508.

Chatterjee S, Sit BR, Saha PK, Ghosh D and Debnath A (2014). Relative performance of rice-potato-green gram system in red and lateritic zone of West Bengal under organic, inorganic and integrated nutrient management. An Intl. quarterly J of life sci. 9(4): 1411-1418.

Getie AT, Dechassa N and Tana T (2015). Response of Potato (Solanum tuberosum L.) Yield and Yield Components to Nitrogen Fertilizer and Planting Density at Haramaya, Eastern Ethiopia. Journal of Plant Science 3(6): 320-328.

Khurana PSM and Naik PS (2003). The potato production and utilization in sub tropics. pp. 1-14. Mehta Publ., New Delhi.

Khurana SC and Bhutani RD (2005). Effect of FYM, biofertilizer and inorganic fertilizer on potato. *Potato J* 32(3 – 4).

Mohammadi GR, Ajirloo AR, Ghobadi ME and Najaphy A (2013). Effects of non-chemical and chemical fertilizers on potato yield and quality. J of Medicinal Plants Res. **7**(1): 36-42.

Najm AA, Hadi HS, MR, Fazeli F, Taghi DM and Shamorady R. (2010). Effect of Utilization of Organic and Inorganic Nitrogen Source on the Potato Shoots Dry Matter, Leaf Area Index and Plant Height, During Middle Stage of Growth. Intl. J of Bio, Biomolecular, Agri., Food and Biotech. Eng. 4(11): 852-855.

Powon MP, Aguyoh JNA and Mwaja V (2005). Effects of inorganic fertilisers and farmyard manure on growth and tuber yield of potato. African Crop Sci. conference proceedings, **7**: 1089-1093.

Sarkar S, Natarajan S and Thamburaj S (2011). Effect of different organic and inorganic sources of nutrients on productivity and profitability of potato cultivars. Egypt Journal of Soil Science 47(4):329-332.

Singh BK, Brijesh R and Verma RB (2014). Effect of integrated Nutrient Management on growth and tuber yield of potato cv. Kufri Ashoka. Indian Journal of Agronomy 7(9): 815-817.

Yourtchi MS, Hadi MHS and Mohammad TD (2013). Effect of nitrogen fertilizer and vermicompost on vegetative growth, yield and NPK uptake by tuber of potato (Agria CV.). Intl J Agri Crop Sci **5**(18), 2033-2040.