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Impact of Various Organic Treatments on Growth, Yield and Quality Parameters of Potato

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ABSTRACT

The experimental findings were revealed that the treatment showed better response to plant growth and its attributes and quality. However, maximum yield (225.26q/ha) were obtained with the application of T_7-Absolute control with recommended dose of NPK (150:100:120 kg/ha) package of practices. The maximum specific gravity 1.07) recorded in T_6 (FYM on N basis as per the recommended dose of all crops in the rotation. Plant protection measure may be taken through bio pesticide only). The maximum dry matter content of tubers (19.66%) was recorded in treatment T_4-Crop residue incorporation + biofertilizers (Azotobacter and Phosphobacteria) + Vermicompost @ 5 t/ha + microbial culture to decomposed residues and minimum dry weight of tubers noted in Treatment T_1 (18.46%) with application of crop residues incorporation during winter season. The maximum starch content (17.81%) of tuber was recorded in the T_4 (Crop residue incorporation + biofertilizers (Azotobacter and Phosphobacteria) + Vermicompost @ 5 t/ha + microbial culture to decomposed residues). There was found most beneficial and feasible for cultivation of organic potato (Kufri Anand).

Key words: *Potato, Bacillus, Azotobactor, PCB, Vermicompost.*

INTRODUCTION

Potato (*Solanum tuberosum* L.) belongs to the order Solanales in the Solanaceae or nightshade family of flowering plants. The trend of organic farming is getting momentum because people prefer to consume vegetable free from chemical residues. On the other hand, the ecological concerns regarding residual toxicity due to indiscriminate and excessive use of chemicals by means of fertilizers and pesticides and their harmful effects on soil health as well as on biodiversity indicates an urgent need for a shift to available organic resources as manure along with fertilizers. The organic manures not only supply the nutrients but also improve the physical environment for better plant and tuber growth. The manures are low analysis nutrient carriers yet play a significant role in the fertilizer economy.

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The yields obtained with combined use of organic manures and fertilizers are higher than fertilizer alone. As such, the knowledge of fertilizers equivalent to orgainc manures is essential for making a sound fertilizers programme. The manures alone are poor sources of nitrogen for obtaining optimum potato yield but improve organic carbon status of soil. Persently, FYM is a major source of orgainc matter and nutrients, besides poultry manure and vermicompost. These orgainc sources generally contain low level of nutrients and are required in higher amounts to fulfill the needs of crop, therefore, it is essential to supply the nutrient in integrated manner. By this way the dependence on fertilizer can be reduced in the days to come and in the mean time the soil will also develop its quality and fertility satus by the continuous use of organic sources. Application of organic sources in conjunction with fertilizers ensures Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, includingbio-diversity, biological cycles and soil-biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adopted systems. Farm yard manure (FYM) is the most common organic manure used in India. Biofertilizers (Azotobacter + phosphobacteria) have been recognized as cheapest fertilizer input for developing countries like India as source of supplement on the application of chemical fertilizer for better crop production.

MATERIALS AND METHODS

The experiment was laid out in a randomized complete block design (RCBD) with seven treatments replicated four times. The experimental plots were 20 in total and each block had 5 experimental plots. Each plot had 5 bags (with one tuber) giving a total of 100 planted tubers. The field experiment was carried out at Vegetable Research Centre of Department of vegetable Science,Narendra Deva University Agricultural and technology Kumarganj Faizabad during autumn-winter season. Experiement was conducted in factorial randomized block design with three replications having seven treatment combinations viz.; T,-Recommended dose of T1- Crop residue incorporation, T2- Crop residue incorporation of all crop + microbial culture to decomposed crop residue, T3- Crop residue incorporation + biofertilizers (*Azotobacter* and phosphobacteria) to all crops + microbial culture to decomposed residues, T4-Crop residue incorporation + bio fertilizers (*Azotobacter* and Phosphobacteria) + Ver, T5- T_3+ FYM @ 20t/ha to potato + Microbial culture to decomposed crop residues, T6- FYM on N basis as per the recommended dose of all crops in the rotation. Plant protection measure may be taken through bio pesticide only, T7- Absolute control with recommended dose of NPK (150:100:120 kg/ha) package of practices (no organic and inorganic fertilizers are used). As per the treatment, FYM was applied during final land preparation. Half of N, full P and K applied as basal and remaining half of N was applied as top dressing at the time of earthing up (30 DAP). The crops were raised by following the recommended practice of the region.

RESULTS AND DISCUSSION

The present investigation has been carried out during winter season (October to January) to find out the appropriate organic nutrient management for improving plant growth, yield and quality parameters to response of potato *(Solanum tuberosum* L.). The experimental findings obtained in present studies due to application of various sources of organic manures in table.

Table: Effect of various organic fertilizers on growth, yield and quality of potato

Treatment	Plant emergence (%)	Plant height (cm)	Number of compound leaves per plants	Number of haulms per plant	Total number of tubers per plot	Total yield of tubers (q/ha)	Specific gravity of tubers	Dry matter content of tubers (%):	Starch content of tubers
T1	95.21	25.50	40.50	4.20	851.75	122.89	1.02	18.46	16.64
T2	95.00	27.90	46.40	4.90	936.25	145.14	1.06	19.36	17.65
T3	95.63	30.20	49.10	5.20	960.25	149.10	1.03	18.75	16.90
T4	95.42	31.50	52.50	5.60	987.50	159.01	1.03	19.66	17.81
T5	97.0	33.60	56.70	6.00	953.25	164.47	1.03	18.96	17.04
T6	95.21	36.20	60.10	6.20	982.75	167.01	1.07	19.16	17.25
T7	96.67	41.50	68.50	7.10	1121.75	225.26	1.04	18.85	16.95
SEm±	**1.31**	**1.14**	**1.76**	**0.15**	**22.33**	**5.76**	**0.01**	**0.26**	**0.23**
CD(p=0.05)	**NS**	**3.40**	**5.24**	**0.44**	**66.33**	**17.11**	**NS**	**NS**	**0.70**

Number of haulms, plant height and number of leaves were significantly improved with the various treatments of organic fertilizers in winter season. Treatment T_7 (Absolute control with recommended dose of NPK (150:100:120 kg/ha) package of practices) showed maximum percentage of emergence of investigation. The reason for such beneficial response might be due to the fact that large amount of FYM improved the soil structure, water holding capacity, soil aeration and supply of nutrients through the use of balanced fertilizers, which resulted in better plant growth in comparison to other treatments.Treatment of various organic sources significantly influenced the number of haulms per hill. Application of treatment T_7 (Absolute control with recommended dose of NPK (150:100:120 kg/ha) package of practices) recorded higher number of stems per hill which was superior over rest of the treatments. The application of treatment T_7 provided sufficient nutrients for better growth of stems. The present findings in accordance with Panigarhi and Behra[4]. Concluded that nitrogen levels and inoculating with *Azotobacter* significantly increased the number of stems per tuber. Various organic sources of nutrients markedly increased the plant height and number of leaves. Application of treatment T_7 (Absolute control with recommended dose of NPK (150:100:120 kg/ha) package of practices) gave maximum plant height and number of leaves per hill. This clearly indicated that higher levels of nutrients which helped in cell elongation of stem due to development of cell and rapid cell division and cell elongation in meristematic region of plant. Similar findings have also been reported by El Gamal[1], Ghosh and Das[2]. The grade wise number and yield of tubers were significantly affected with various organic sources of nutrients. The maximum weight of tubers of A and B grade were found in T_7. The maximum total weight was also found in T_7 treatment followed by T_6 treatment. The similar finding were also reported by Patel and Mehta[5].

The total yield of tubers was significantly affected by application of various organic sources of nutrients and absolute control with recommended package of practices. The maximum total yield of tubers (225.26 q/ha) were obtained with treatments T_7 (Absolute control with recommended dose of NPK (150:100:120 kg/ha) package of practices) followed by T_6 treatment (167.01q/ha). The higher yield of tubers have been achieved which might be due to higher yield attributes obtained viz., number of A, B, C and D grades and weight of A, B, C and D grades of tubers. The another scientific explanation for achieving higher yield of tubers might be due to balanced supply of N P & K through chemical fertilizers alone and N P K and other nutrients provided through combination of FYM, bio-fertilizers like Azotobacter, Phosphobacteria & vermicompost. The present findings are in conformity to Mondal, *et al*[3].

The per cent dry matter content of tubers decreased with the application of treatment T_7 (Absolute control with recommended dose of NPK (150:100:120 kg/ha) package of practices. However, the maximum dry matter per cent was recorded with the application of treatment T_4 (Crop residue incorporation + biofertilizers (*Azotobacter* and Phosphobacteria) + Vermicompost @ 5t/ha + microbial culture to decomposed residues) which was non-significantly higher than other treatments. Higher dry matter content (%) was achieved which might be due to combined application of biofertilizers (*Azotobacter* and Phospho-bacteria) and vermicompost that played a positive role in affecting dry matter of tubers. Similar findings are also reported by Pathak[6]. Nitrogen fertilizer reduced the dry matter percentage of tubers perhaps by encouraging the production of protoplasm which is largely composed of water. Dry matter content of tubers has reduced due to higher dose of nitrogen as reported by Sood[7]. Maximum specific gravity was recorded with the application of treatment T_6 (FYM on N basis as per the recommended dose of all crops in the rotation. Plant protection measure may be taken through bio pesticide only) followed by treatment T_2 (Crop residue incorporation of all crop + microbial culture to decomposed crop residue. Similar finding was also reported by Verma and Sharma[9].

Starch content of potato tubers was significantly influenced by the application of various organic sources of nutrients. Maximum starch content was obtained with the application of treatment T_4 (Crop residue incorporation + biofertilizers (*Azotobacter* and Phosphobacteria) + Vermicompost @ 5t/ha + microbial culture to decomposed residues). The reason for the higher starch content with the application of treatment T_4 might be due to continued application of biofertilizer (*Azotobacter* and Phosphobacteria) + Vermicompost @ 5t/ha + microbial culture to decomposed residues) which works on the photosynthesis of plant and due to enhancement of photosynthesis, starch, sugar and cellulose synthesis might have improved[6].

CONCLUSION

Concluded that the increase in growth, yield and quality of potato with addition of biofertlizers as compared to using chemical fertilizers. Addtition of vermicompost into potato crop field with organic could be very effective response on the growth of potato. The mineralization of organic matter, decrease of soil pH by organic acids produced in vermicompost and increases micronutrient complexes formation.

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