Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(4): 2890-2894
Received: 10-05-2019
Accepted: 12-06-2019

Shani Raj
Department of Vegetable Science, BTC CARS, Bilaspur (C.G.), IGKV, Raipur, Chhattisgarh, India

Dr. RK Bisen
Department of Vegetable Science, BTC CARS, Bilaspur (C.G.), IGKV, Raipur, Chhattisgarh, India

Dr. SK Verma
Department of Vegetable Science, BTC CARS, Bilaspur (C.G.), IGKV, Raipur, Chhattisgarh, India

Dr. HP Agrawal
Department of Vegetable Science, BTC CARS, Bilaspur (C.G.), IGKV, Raipur, Chhattisgarh, India

Dr. NK Chaure
Department of Vegetable Science, BTC CARS, Bilaspur (C.G.), IGKV, Raipur, Chhattisgarh, India

Shri V Nirmalkar
Department of Vegetable Science, BTC CARS, Bilaspur (C.G.), IGKV, Raipur, Chhattisgarh, India

Correspondence
Shani Raj
Department of Vegetable Science, BTC CARS, Bilaspur (C.G.), IGKV, Raipur, Chhattisgarh, India

Effect of integrated nutrient management on growth and yield of potato (*Solanum tuberosum* L.)

Shani Raj, Dr. RK Bisen, Dr. SK Verma, Dr. HP Agrawal, Dr. NK Chaure and Shri V Nirmalkar

Abstract
The present investigation entitled "Effect of integrated nutrient management on growth and yield of potato (*Solanum tuberosum* L.)" was carried out in Horticulture Research cum Instructional Farm of Barrister Thakur Chhedilal College of Agriculture and Research Station, Sarkanda, Bilaspur (C.G.), during Rabi season of Nov 2018 to Mar 2019, The field experiment was laid out in randomized block design with 3 replications and 12 different treatment combinations viz. T1 (125% RDF (187:125:125 kg ha^{-1} NPK), T2 (100% RDF (150:100:100 kg ha^{-1} NPK), T3 (75% RDF + FYM @ 7.5 t ha^{-1}(25% N by FYM), T4 (50% RDF + FYM @ 15 t ha^{-1}(50% N by FYM), T5 (75% RDF + Vermicompost @ 3.75 t ha^{-1} (25% N by Vermicompost), T6 (50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost), T7 (Tuber treatment with Trichoderma @ 20 g /k + soil incorporation of Trichoderma enriched FYM @ 15 t ha^{-1} SOIL, T8 (Tuber treatment with Pseudomonas @ 20 g /k + soil incorporation of Pseudomonas enriched FYM @ 15 t ha^{-1} soil, T9 (Tuber treatment with Pseudomonas followed by Trichoderma @ 20 g /k + soil incorporation of consortia of Pseudomonas & Trichoderma enriched FYM @ 15 t ha^{-1} soil, T10 (Tuber treatment with consortia of Azotobacter & PSB @20 g /k + soil incorporation of consortia of Azotobacter & PSB enriched FYM @ 15 t ha^{-1} soil, T11 (50% RDF only FYM @ 15 t ha^{-1} (50% N by FYM) and T12 (Local control), T6 (50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost), Integrated use of synthetic fertilizers and organic manures showed the significant impact on growth and yield attributes of potato. has resulted in plant height plant height (44.13 cm), number of green leaves and number of shoots per plant (66.40 and 4.37 respectively), and crop growth rate (2.17g/m^2/day,) fresh tuber weight per plant (145.67 g), and number of tuber late per plant (18.67), 70 & 90 DAS and at harvest, respectively) And most of the yield and yield attributing characters viz., number of tuber per plant (10.67) fresh tuber weight per plant (295.67 g) tuber girth (5.05 cm), marketable yield (25.99 t/ha), total tuber yield (27.36 t/ha) were observed significantly higher with the application of 50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost) apart from this the highest net income The highest net returns (Rs. 227218.94) and benefit cost ratio (B:C ratio) (2.03) were recorded with the treatment of T_1 (125% RDF (187:125:125 kg ha-1 NPK) and also followed by T_6- (50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost) (Rs. 224101.35) and benefit cost ratio (B:C ratio) (1.78) was also similar result.

Keywords: Triclosan, TCS, determination, detection, sensor

Introduction
Potato (*Solanum tuberosum* L.) is one of the most important basic vegetable and staple food-crop of the world as well as Indian continents which belong to family solanaceae. Potato is world's fourth important food crop after wheat, rice and maize (Rana, M.K. 2008) [16]. More than a billion people worldwide eat potato, the potato is the third most important food crop in the world after rice and wheat in terms of human consumption, it is originated from Andes of Peru in South America.

It is introduced in India in early 17th centuries either by Portuguese or the Britishers which is grown throughout the country commercially from sea level to temperate region (upto 4000 MSL). Potato is one of the value added and exportable items.

The widely grown potato is an autotetraploid with 2n=48. The potato is unique and different from other crops in that sense the food material is stored in underground stem parts called tubers. Potato provides a source of low cost energy to the human diet and it is the rich source of starch, vitamin C and B and minerals (Kumar *et al*., 2013; Lokendrajit *et al*., 2013). It is a heavy feeder of plant nutrients having very high requirement of nitrogen, phosphorus, potassium and other nutrients. Potato is known as protective food because potato protein is rich in lysine which is one of the most important amino acid. The potato is a highly nutritious, easily digestible, wholesome food which contains 77.20 % water and the rest is dry matter. Average dry matter composition is 16.30% starch, 0.9% sugar (0.6 total sugar and 0.3 reducing sugar), 4.40% protein (2.8% crude and 1.60% true protein), 0.9%

minerals, 0.59% fiber, 0.14% crude fat and considerable amount of vitamin A and C (Bose, 1993) [6].

Potato is high yielding and more nutrient required crop. The growth, development and yield of potato are mainly governed by nutrient availability through major nutrients. Nitrogen, phosphorus and potassium are major nutrients required for cultivation of potato. Nitrogen is a constituent of protoplasm and it is helpful for chlorophyll synthesis. Phosphorus increases the growth of shoots, roots and tuber formation in potato. Whereas, potassium help to provide resistance against diseases and pests. There are many sources of nitrogen, phosphorus and potassium through organic fertilizers

Material and Methods

A field experiment was conducted at the Horticulture Research cum Instructional Farm of Barrister Thakur Chhedilal College of Agriculture and Research Station, Sarkanda, Bilaspur (C.G.), during Rabi season of 2018, to study "Effect of integrated nutrient management on growth and yield of potato (*Solanum tuberosum* L.)*"* The details of the materials used and methods adopted during the course of investigation are described in this chapter.

During the crop period the maximum temperature varies between 22.43 °C to 31.54 °C whereas, minimum temperature ranges between 6.94 °C to 15.17 °C .The maximum and minimum relative humidity varied between 97.00 to 38.43 per cent respectively. Evaporation recorded between 1.57 to 4.01 mm per day. The soil of experimental site was alluvium soil & vertisol belonging to textural class clay. The experiment consisted of the following treatments involving organics viz., Farmyard manure, vermicompost and biofertilizers (applied before planting) in different percentage to substitute the recommended dose of fertilizer on nitrogen basis. The recommended fertilizer dose for potato is 150:100:100 kg NPK ha^{-1}, well decomposed farm yard manure and vermicompost containing 0.5 and 2.5 % N; 0.2 and 2.5 % P O; 0.5 and 0.6 % K O, respectively were incorporated in the soil. Half dose of nitrogen and full dose of phosphorus and potassium through urea, single supper phosphate and muriate of potash were applied as basal dressing. The remaining half doseof nitrogen was top dressed at first earthing up operation. Observations were recorded on crop growth parameters Plant emergence was recorded viz., Initial and final plant population, Plant height (cm) - 30, 50 and 70 DAS, Number of green leaves, per plant - 30, 50 and 70 DAS, Number of shoots per plant - 30, 50 and 70 DAS, Crop Growth Rate (CGR) at- 30, 60 and 90 DAS, Fresh weight per plant at- 30, 60 and 90 DAS, Number of tuber late per plant at - 30, 60 and 90 DAS, as influenced by effect of integrated nutrient management are presented here under. And yield parameter recorded viz., Number of tubers per plant, Fresh Tuber weight per plant (g), Total tuber yield per hectare (t), Tuber girth (cm), Marketable and Non-marketable tuber yield (t ha^{-1}) ,

Results and Discussion

The quantity of nutrients through organic sources were supplied in three forms viz., farmyard manure, vermicompost and biofertilizers at different levels on the basis of % nitrogen content. Inorganic major nutrients were supplied in the form of urea, single supper phosphate (SSP) and miurate of potash (MOP) to supply N, P and K, respectively. Among the different treatments, application of T_6- (50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost) had resulted in higher plant height (44.13 cm), number of green leaves and number of shoots per plant (66.40 and 4.37 respectively), and crop growth rate (2.17g/m^2/day,) fresh tuber weight per plant (145.67 g), and number of tuber late per plant (18.67), 70 & 90 DAS and at harvest, respectively) was noticed in case of 50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost) given the Table : 1.1

Most of the yield and yield attributing characters viz., number of tuber per plant (10.67) fresh tuber weight per plant (295.67 g) tuber girth (5.05 cm), marketable yield (25.99 t/ha), total tuber yield (27.36 t/ha) were observed significantly higher with the application of 50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost) given the Table 1.2

The highest Gross returns (Rs. 350168.35) and benefit cost ratio (B:C ratio) (1.78) were recorded with the treatment of T_6- (50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost) and also followed by T_1 (125% RDF (187:125:125 kg ha-1 NPK) (Rs. 339393.94) and benefit cost ratio (B:C ratio) (2.03). and the lowest or negative gross return (Rs. 150841.75) and benefit cost ratio (B:C ratio) (0.55) were recorded in the treatment T_{12} (Local control). given the Table 1.3.

The highest net returns (Rs. 227218.94) and benefit cost ratio (B:C ratio) (2.03) were recorded with the treatment of T_1 (125% RDF (187:125:125 kg ha-1 NPK) and also followed by T_6- (50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost) (Rs. 224101.35) and benefit cost ratio (B:C ratio) (1.78). and the lowest or negative net return (Rs. 42409.36) and benefit cost ratio (B:C ratio) (0.34) were recorded in the treatment T_9 (Tuber treatment with Pseudomonas followed by Trichoderma @ 20 g /k + soil incorporation of consortia of Pseudomonas & Trichoderma enriched FYM @ 15 t ha-1 soil). Given the Table 1.3.

Therefore, the better combination of organic and inorganic nutrient sources in the proportion of 50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost) are a promising low cost option in the production of high yields and better quality of potato with good returns.

Table 1: Crop growth parameters recorded table

Trt. No.	Treatment Details	plant population		Plant height (cm)	Number of green leaves per plant	Number of shoots per plant	Crop growth rate (g/m^2/day)	Fresh weight per plant (g)	Number of tuber late per plant
		At 30 DAS	At harvest	70 DAS	70 DAS	70 DAS	90 DAS	90 DAS	90 DAS
T_1	125% RDF (187:125:125 kg ha^{-1} NPK)	41.67	40.67	41.3	62.57	3.9	2.73	138.67	17.33
T_2	100% RDF (150:100:100 kg ha^{-1} NPK)	41	40	35.4	38.93	3.53	1.69	133.33	14.67
T_3	75% RDF + FYM @ 7.5 t ha^{-1}(25% N by FYM)	40.67	39.67	37	37.53	3	2.18	122	13
T_4	50% RDF + FYM @ 15 t ha^{-1}(50% N by FYM)	40.67	39.67	36.13	44.6	3.27	2.32	108.67	10.33
T_5	75% RDF + Vermicompost @ 3.75 t ha-^{1} (25% N by Vermicompost)	39.67	38.67	33.9	46.4	3.33	2.65	101.33	9.33
T_6	50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost)	42	41.67	44.13	66.4	4.37	2.71	145.67	18.67

T_7	Tuber treatment with Trichoderma @ 20 g /k + soil incorporation of Trichoderma enriched FYM @ 15 t ha^{-1} soil	40	39.33	34.27	42.13	3.17	1.57	106	9.67
T_8	Tuber treatment with Pseudomonas @ 20 g /k + soil incorporation of Pseudomonas enriched FYM @ 15 t ha^{-1} soil	40	38.33	30.73	34.67	3	2.17	97	10.67
T_9	Tuber treatment with Pseudomonas followed by Trichoderma @ 20 g /k + soil incorporation of consortia of Pseudomonas & Trichoderma enriched FYM @ 15 t ha^{-1} soil	40.33	40	30	52.8	3.73	2.3	113	12.67
T_{10}	Tuber treatment with consortia of Azotobacter & PSB @20 g /k + soil incorporation of consortia of Azotobacter & PSB enriched FYM @ 15 t ha^{-1} soil	41.33	40.33	38.93	58.9	3.83	3.13	137	16.67
T_{11}	50% RDF only FYM @ 15 t ha^{-1} (50% N by FYM)	39.67	39.33	36.83	39.13	3.47	1.84	118	10
T_{12}	Local control	38.67	35.33	27.93	32.53	2.77	1.54	91	7.33
Sem (±)		1.66	1.66	2.62	3.01	0.30	0.17	9.29	0.74
CD (5%) =		NS	NS	7.68	8.83	0.87	0.51	27.24	2.17
CV (%) =		7.13	7.13	12.75	11.24	14.96	13.52	13.67	10.25

Table 2: Yield and yield attributing characters

Trt. No.	Treatment Details	Number of tubers per plant	Fresh Tuber weight per plant (g)	Tuber girth (cm)	Total tuber yield per hectare (t)
T_1	125% RDF (187:125:125 kg ha^{-1} NPK)	10.27	264.97	4.67	26.52
T_2	100% RDF (150:100:100 kg ha^{-1} NPK)	7.87	234.80	4.29	21.89
T_3	75% RDF + FYM @ 7.5 t ha^{-1}(25% N by FYM)	7.27	147.47	4.09	21.46
T_4	50% RDF + FYM @ 15 t ha^{-1}(50% N by FYM)	8.87	239.63	4.42	23.23
T_5	75% RDF + Vermicompost @ 3.75 t ha^{-1} (25% N by Vermicompost)	6.47	125.17	4.03	22.22
T_6	50% RDF + Vermicompost @ 7.5 t ha^{-1} (50% N by Vermicompost)	10.67	295.67	5.05	27.36
T_7	Tuber treatment with Trichoderma @ 20 g /k + soil incorporation of Trichoderma enriched FYM @ 15 t ha^{-1} soil	8.40	196.07	4.10	18.94
T_8	Tuber treatment with Pseudomonas @ 20 g /k + soil incorporation of Pseudomonas enriched FYM @ 15 t ha^{-1} soil	7.20	141.93	3.77	16.25
T_9	Tuber treatment with Pseudomonas followed by Trichoderma @ 20 g /k + soil incorporation of consortia of Pseudomonas & Trichoderma enriched FYM @ 15 t ha^{-1} soil	6.87	180.37	3.87	13.05
T_{10}	Tuber treatment with consortia of Azotobacter & PSB @20 g /k + soil incorporation of consortia of Azotobacter & PSB enriched FYM @ 15 t ha^{-1} soil	9.20	246.23	4.60	24.41
T_{11}	50% RDF only FYM @ 15 t ha^{-1} (50% N by FYM)	7.47	168.07	4.16	14.73
T_{12}	Local control	5.20	97.80	3.31	11.78
Sem (±)		0.82	6.19	0.24	2.33
CD (5%) =		2.41	18.16	0.71	6.85
CV (%) =		17.84	5.50	9.95	20.06

Table 3: Integrated nutrient management gross realization, total cost of cultivation, net profit (ha^{-1}) and cost benefit ratio of potato

Treatment no.	Treatments	Common cost of cultivation (Rs)	Variable cost of cultivation (Rs)	Total Cost Of Cultivation (Rs)	Gross Return (Rs)	Net return (Rs)	B:C Ratio
T1	125% RDF (187:125:125 kg ha-1 NPK)	97407	14768	112175	339393.94	227218.94	2.03
T2	100% RDF (150:100:100 kg ha-1 NPK)	97407	12320	109727	280134.68	170407.68	1.55
T3	75% RDF + FYM @ 7.5 t ha-1(25% N by FYM)	97407	16733	114140	274747.47	160607.475	1.41
T4	50% RDF + FYM @ 15 t ha-1(50% N by FYM)	97407	21160	118567	297373.74	178806.737	1.51
T5	75% RDF + Vermicompost @ 3.75 t ha-1 (25% N by Vermicompost)	97407	20483	117890	284444.44	166554.444	1.41
T6	50% RDF + Vermicompost @ 7.5 t ha-1 (50% N by Vermicompost)	97407	28660	126067	350168.35	224101.35	1.78
T7	Tuber treatment with Trichoderma @ 20 g /k + soil incorporation of Trichoderma enriched FYM @ 15 t ha-1 soil	97407	27187	124594	242424.24	117830.242	0.95
T8	Tuber treatment with Pseudomonas @ 20 g /k + soil incorporation of Pseudomonas enriched FYM @ 15 t ha-1 soil	97407	27187	124594	207946.13	83352.1279	0.67
T9	Tuber treatment with Pseudomonas followed by Trichoderma @ 20 g /k + soil incorporation of consortia of Pseudomonas & Trichoderma enriched FYM @ 15 t ha-1 soil	97407	27187	124594	167003.37	42409.367	0.34
T10	Tuber treatment with consortia of Azotobacter & PSB @20 g /k + soil incorporation of	97407	27187	124594	312457.91	187863.912	1.51

	consortia of Azotobacter & PSB enriched FYM @ 15 t ha-1 soil						
T11	50% RDF only FYM @ 15 t ha-1 (50% N by FYM)	97407	15000	112407	188552.19	76145.1886	0.68
T12	Local control	97407	0	97407	150841.75	53434.7508	0.55

Conclusion

1. The maximum gross return (339393.94 Rs ha^{-1}) and net return (227218 Rs ha^{-1}) was realized under 125% RDF followed by 50% RDF + Vermicompost @ 7.5 t ha^{-1} T_6 and T_{10} which were approximately similar in gross and net return.
2. The lowest gross return (150841 ha^{-1}) and lowest net return (42409.36 ha^{-1}) was recorded under T9 treatment.
3. In respect of benefit cost ratio, treatment T1 shows maximum value (2.03) which was similar to the treatment T_6*i.e*. (1.78). Lowest B:C ratio was observed in the T9 treatment showing value of 0.34.
4. On the basis of above findings, treatment T6 stand first in position and T_1 stand in second order of preference. However treatment T10 comes in next in order. There for it may be concluded that treatment 50% RDF + Vermicompost @ 7.5 t ha^{-1} (T_6) may be prefer for nutrient management in potato.

References

1. Ahamad S, Dagar JC, Mani D. Impact of FYM and potassium interactions on potato yield multivated on moderate saline soils. Journal of Soil Salinity and Water Quality, 2014; 6(1):59-63.
2. Alam MN, Jahan MS, Ali MK, Ashraf M, Islam MK. Effect of vermicompost and chemical fertilizer on growth, yield and yield components of Potato in Barind Soils of Bangladesh. Journal of Applied Sci. Res. 2007; 3(12):1879-1888.
3. Anonymous. Area, production and productivity of potato in Chhattisgarh. Directorate of Horticulture, Chhattisgarh Govt, 2005b.
4. Baishya LK, Kumar M, Ghosh DC. Effect of different proportionof organic and inorganic nutrients on productivity and profitability of potato (*Solanum tuberosum* L) varieties in Meghalaya hills, 2010, 230-234.
5. Banafar RNS, Billore M, Khushwah SS. Integrated plant nutrition approaches for potato. Potato Journal. 2005; 32(3-4):244.
6. Bose TK, Som MG, Kabir T. Vegetable Crops in India. Naya Prakash, Calcatta, India, 1993.
7. Chettri M, MandaI SS, Konar A. Integrated nutrient management for enhancing productivity and sustaining soil fertility under potato (*Solanum tuberosum*)-based cropping system in West Bengal. Indian J Agric Sci. 2004; 74(4):210-12.
8. Kumar, Sharma *et al.*, reported that the application of 150 % of the recommended dose NPK increased the tuber yield which might be attributed to better crop growth i.e. plant height, the number of stems, number and size of tubers, 2002.
9. Kumar P, Pandey S, Singh BP, Kumar D. Influence of Source and Time of Potassium Application on Potato Growth, Yield, Economics and Crisp Quality. Potato Research. 2007; 50(1):1-13.
10. Kushwah VS, Singh SP, Lal SS. Effect of manures and fertilizers on potato (*Solanum tuberosum*) production. Potato J. 2005; 32(3-4):157-158.
11. Mojtaba Sohrabi Yourtchi, Mohammadreza Haj, Seyyed Hadi, Mohammad Taghi, Darzi. Effect of nitrogen fertilizer and vermicompost on vegetative growth, yield and NPK uptake by tuber of potato. International Journal of Agriculture and Crop Science, 2013. www.ijacs.com
12. Pandey SK. Vegetable Science, Central Potato Research Institute, Shimla 171001. 2007.
13. Prasad H, Sajwan P, Kumari M, Solanki S. Effect of Organic Manures and Biofertilizer on Plant Growth, Yield and Quality of Horticultural Crop. International Journal of Chemical Studies. 2016; 5(1):217-221.
14. Raghav M, Chandra R. Effect of seed soaking and biofertilizers on growth, yield and nutrient uptake by potato at two fertility levels. Progressive Hort. 2005; 37(7):157-162.
15. Raghav M, Kumar T, Kamal S. Effect of organic sources on growth, yield and quality of potato. Annals of Horticulture. 2008; 1:67-70.
16. Rana MK. Olericulture in India. Kalyani Publishers, Ludhiana, 2008.
17. Sarkar A, Sarkar S, Zaman A. Growth and yield as influenced by combination of organic manures and inorganic fertilizers. Potato Journal. 2011; 38 (1):78-80.
18. Sarkar B, Mondal SS, Nayek SS, Sahaand M, Biswas S. Integrated nutrient management for the productivity and quality improvement of Potato under irrigated conditions. Potato Journal. 2007; 34(1,2):99-100.
19. Selvamani P, Manivannam K, Mohan J. Impact of organic manures, inorganic fertilizers and biofertilizers on the nutrient concentration in soil at different growth stages of banana cv. Pooran Mysore. Plant Archives. 2011; 11:1165-1168.
20. Sharif Hossain ABM, Hakim MA, Onguso M. Effect of manures and fertilizers on the growth and yield of potato. Pakistan Journal of Biological Sciences, 2003; 6:1243-1246.
21. Singh SD. Combination of phosphate solubilizing biofertilizer (bacteria) on tuber yield of potato, Global conference on potato production, New Delhi, Abstract. 1999, 132.
22. Singh SN, Singh BP, Singh OP, Singh R, Singh RK. Effect of nitrogen application in conjugation with biofertilizer on the growth, yield and quality of potato under indo-gangetic plain region. Potato Journal. 2007; 34 (1-2):103-104.
23. Singh KP, Singh RK, Singh SN, Singh VK. Effect of fertilizer level, seed rate and seed size on yield of potato in acidic soils of Manipur. Potato Journal. 2007; 34(1-2): 93-94.
24. Sood MC. Integrated nutrient supply and management for potato production in mid hills of Shimla. Potato Journal. 2007; 34(1-2):101-102.
25. Subba Rao A, Sammi Reddy K. Integrated nutrient management vis-à-vis crop production/productivity, nutrient balance, farmer livelihood and environment. Indian Inst. Soil Sci., Nabi Bagh, Berasia Road, Bhopal (India), 2008.
26. Sud KC, Jatav MK, Trehan SP. Effect of NPK applied from organic and inorganic sources on the performance

of potato under rainfed condition in Shimla hills. Potato Journal. 2005; 32(3-4):153-154.
27. Uzma B, Qureshi F. Effect of nitrogen and farm yard manure on growth, nutrient content and quality of potato (*Solanum tuberosum* L.). An International Quarterly Journal of Biology and Life Sciences. 2014; 2 (3):786-791.
28. Vadiraj Ba, Krishna kumar M, Jayakumar, Naidu R. Studies on vermicompost and the effect on cardamom nursery seedlings. Proc. Nation. Symp. Soil Biol. Ecol., Calicut, 1992, 47.
29. Yadav KS, Singh N, Suneja S, Malik YS, Nehra BK, Narula N. Nitrogen economy through the use of Azotobacterbio fertilizer in potato. Journal Indian Potato assoc. 2003; 30(1-2):81-82.
30. Yawalker KS, Agrawal JP, Bokde S. Bulky organic manure. Manure and Fertilizers. Ed 5th. 1996, 25-75.