The Pharma Innovation Journal 2023; 12(4): 1770-1774

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(4): 1770-1774

www.thepharmajournal.com
Received: 25-01-2023
Accepted: 28-02-2023

Muktilata Tirkey
Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Rajshree Gayen
Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Praveen Sharma
Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Yugal Kishor Lodhi
Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Pushpa Lata Tirkey
Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Vanadana Yadav
Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Corresponding Author:
Muktilata Tirkey
Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Integrated nutrient management in potato under Chhattisgarh plain

Muktilata Tirkey, Rajshree Gayen, Praveen Sharma, Yugal Kishor Lodhi, Pushpa Lata Tirkey and Vanadana Yadav

Abstract
The present "study of integrate nutrient management in potato under Chhattisgarh plain'' was conducted during *rabi* season 2018-190 and 2019-20 at Research Farm of Department of Horticulture, College of Agriculture, Indira Gandhi krishi Vishwavidyalaya, Raipur Chhattisgarh. The experiment was consisted of nine treatments replicated thrice in Randomized Block Design. During the experiment, various observations such as emergence per cent and growth paramerts of the treatments were evaluated with respect to inorganic fertilizers with organic manure and biofertilizers. The emergence per cent was recorded at 30 days after planting (DAP). Among growth parameters, plant height, number of shoots per plant, number of branches per plant, number of compound leaves per plant, fresh weight, dry weight and dry matter content of shoots per plant was recorded at 45, 60 and 75 DAP. The study revealed that the emergence percentage and growth parameters were influenced by inorganic fertilizers with organic manure and biofertilizers significantly increased values were obtained. Among nine treatments, 50% FYM + biofertilizer + 50% chemical fertilizer were found best regarding emergence percentage and growth parameter.

Keywords: Potato, bioferilizer, growth parameters, treatment etc.

1. Introduction
Potato is the most important food crop in the world after wheat, rice and maize. Potato belonging to the genus Solanum of family Solanaceae is cross-pollinated herbaceous annual crop with tetraploid chromosome number (48). In order of importance for food production in comparison to other major food crops on a fresh weight basis, potato rank 6th in developing countries, 4th in developed countries and 3rd in India (Khurana and Naik, 2003) [9]. Potato is the most widely grown vegetable crop in the country and it plays a very important role in Indian agriculture as it alone contributes about 21% of the total vegetable area and 28% of the total vegetable production of India. The annual potato production in India was 51.31 million MT from an area coverage of 2.14 million hectares with a productivity of 24.00 tons/ha (DAC & FW, 2019). Uttar Pradesh is the leading potato growing state in the country followed by West Bengal and Bihar (DAC & FW, 2018). Potato plant produces more nutritious food in a shorter time on less land and in a cooler climate than any other food crop. Its tubers have become a staple food in many parts of the world and an integral part of much of the world's food supply. The protein in potato is of good quality concerning essential amino acids in human nutrition. It also has a substantial amount of vitamins, minerals and trace of other nutrients. It is a high calory crop having the immense potential of solving hunger and the nutrient problem of the growing population. It is a source of carbohydrates (22.6 g/100g), starch (16.3 g/100g) and proteins (1.6 g/100g). It also contains a good amount of essential amino acids like leucine, tryptophan and isoleucine (Khurana and Naik, 2003) [9]. Potatoes are being grown in about 150 countries throughout the worth and more than a billion people worldwide eat potato. India is the second largest producer of potato next to china (Scott and Suarez, 2011) [16]. In Chhattisgarh state, it is mainly cultivated in Sarguja, Raigarh, Jashpur, Balrampur and Raipur as a Rabi crop, while presently being grown in an area of 45,435 hectares with an annual production of 6,82,342 tones/ha. and productivity 15.02 tones/ha. (Anonymous, 2019) [1]. In Chhattisgarh, it is cultivated during the Rabi season except in Mainpat hills, where it has been grown in both the kharif and rabi seasons. Potato is a heavy feeder crop and the use of organic, inorganic fertilizers and bio-fertilizer is the best approach for getting economic yield. In this approach plant nutrients can be supplied from different sources *viz* organic manures, previous crop reduces, bio-fertilizers and chemical fertilizers contain higher nutrients than organic

manures, which are relatively slow acting, but supply available nutrients for a longer period. The continuous application of inorganic fertilizers affects soil health adversely whereas the combination of inorganic and organic fertilizers or pure organic fertilizers may maintain soil health properly and subsequently improve soil quality and health in a sustainable manner (Densilin *et al*., 2010) [5]. The use of vermicompost is now a global movement for the second green revolution that emphasizes composting. Biofertilizers have significant advances compared to chemical fertilizers, such as not producing toxic substances, and having the ability to be reported spontaneously; which improves the soil's physical and chemical properties (Pal and Gardener, 2006) [13]. The biological sources of nutrients i.e. *Azotobacter*, phosphobacteria and bacillus have been recognized as the cheapest fertilizer input for improving soil health and fertility for optimum crop production.

2. Methodology

The research trail was carried out during the year 2018-19 and 2019-20 at Research Farm of Department of Horticulture, College of Agriculture, Indira Gandhi krishi Vishwavidyalaya, Raipur Chhattisgarh. The experiment was consisted of nine treatments replicated thrice in Randomized Block Design. The treatments were allocated randomly into the plots in such a way that each and every treatment was received only once in each block. The details of the treatment are described in Table 1.

3. Results and Discussion

Emergence per centage

At 30 DAP during the first year and second year as well as for pooled mean the results showed a non-significant difference among the different treatments of this study. The data clearly showed that the treatment T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) had maximum plant emergence per cent (97.46%, 98.54% and 98.00% respectively in the first year, second year and pooled mean data) followed by T_2 (100% RDF through chemical fertilizer) during the first year, second year and pooled mean data (96.69%, 97.69% and 97.19%). The minimum plant emergences per cent were noticed under the treatment T_1 (Without NPK (control) during the first year, and second year as well as pooled mean data (90.64%, 91.94% and 91.29%). Non-significant results for this trait were found in all treatments, which could be attributed to sufficient food material in the potato tubers planted in all treatments. Similarly Patel (2013) [14] also reported a non-significant difference in plant emergence per cent age with the application of different levels of fertilizers in potato. Nag (2006) [12] recorded a non-significant effect in plant emergence percentage with the soil application of different organic manure and biofertilizers (PSB and *Azotobactor*) in potato.

Table 1: The detail of the treatments

Symbols	Treatments
T_1	Without NPK (control)
T_2	100% RDF through chemical fertilizer
T_3	75% chemical fertilizer + biofertilizer
T_4	FYM + 50% chemical fertilizer
T_5	Vermicompost + 50% chemical fertilizer
T_6	50% FYM + Biofertilizer + 50% chemical fertilizer
T_7	50% Vermicompost + Biofertilizer + 50% chemical fertilizer
T_8	75% FYM + Biofertilizer
T_9	50% Vermicompost + Biofertilizer

Plant Height

At 45 DAP, during the first, second year and pooled mean data recorded on fertilizer application clearly showed that the maximum plant height (40.75, 42.02 and 41.39 cm) was recorded with T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) which was significantly followed by T_2 (100% RDF through chemical fertilizer) 39.34, 40.73 and 40.03 cm and T_4 (FYM + 50% chemical fertilizer) 38.92, 39.83 and 39.37 cm. The minimum plant height (31.22, 32.06 and 31.64 cm) was noticed with the treatment in which no NPK (Control) was applied. During the first year, second year and pooled mean data of fertilizer application at 60 DAP the maximum plant height (46.76, 46.95 and 46.86 cm) was recorded in T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) which was found *at par* with by T_2 (100% RDF through chemical fertilizer) 45.67, 46.43 and 46.05 cm and T_4 (FYM + 50% chemical fertilizer) 43.16, 43.83 and 43.49cm. Whereas, the minimum plant height (39.08, 39.76 and 39.42 cm) was noted under without NPK (control) treatment of both year and pooled mean. The data at 75 DAP during the first year, second year and pooled mean of fertilizer application clearly showed that T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) showed the maximum plant height (49.62, 51.43 and 50.52 cm) which was found at par with T_2 (100% RDF through chemical fertilizer (47.67, 49.61 and 48.64 cm), T_4 (FYM + 50% chemical fertilizer) (46.25, 48.62 and47.43 cm) and T_3 (75% chemical fertilizer + biofertilizer) (44.89, 46.74 and 45.81 cm). The minimum plant height (40.91, 41.57 and 41.24 cm) was noticed under the treatment T_1 (control) which was found statistically similar to T_9 (50% vermicompost + Biofertilizer). The treatments comprising inorganic fertilizers and organic manures in combination with biofertilizers had given significantly better growth. Hence, it could be revealed that the application of inorganic fertilizers along with organic manures and biofertilizers was found to be effective in increasing the height of the plant. The maximum increase in height in this treatment could be attributed to increased soil fertility due to the addition of RDF along with FYM and biofertilizers Raghav *et al.* (2008) [15] reported the highest plant height with the application of FYM @ 10 t ha^{-1} + 100% RDF. Similar results have also been reported by Jaipaul *et al* (2011) [7], Sarkar *et al*. (2011) [17], Yadav *et al* (2014) [20], Dev *et al.* (2020) [6] and Chaudhary *et al* (2022) [3] in potato.

Number of Shoots per plant

At 45 DAP during the first, second and pooled mean data, the maximum number of shoots per plant (5.96, 6.43 and 6.19) was recorded under treatment T_6 (50% FYM + Biofertilizer +

50% chemical fertiliser), which was found to be on par with treatment T_2 (100% RDF through chemical fertilizer) having 5.81, 5.97 and 589 shoots per plant. While the minimum number of shoots per plant (3.34, 3.64 and 3.49 respectively) was noticed under the T_1 control treatment. During the first, second years and the pooled mean data of the investigation at 60 DAP, T_6 (50% FYM + biofertilizers+ 50% chemical fertilizer) showed the maximum number of shoots per plant (6.53, 7.03 and 6.78) but there was no marked difference among other treatments. The minimum number of shoots per plant (4.67, 4.80 and 4.73), noted under the treatment (T_1) control, was found statistically similar to T_9 (50% vermicompost + Biofertilizer). The increase in the number of shoots per plant with increased levels of nitrogen application in this study might be because a higher dose of nitrogen would have stimulated the assimilation of carbohydrates and protein. In the case of potassium, the higher dose was found beneficial in enhancing the number of shoots per plant in this study, possibly due to the role of potassium in forming more tissues. Verma *et al*. (2011) [19] found that the highest number of shoots in treatment receiving crop residue + *Azotobactor* + biodynamic approach +microbial culture in potato the results of the present study regarding the higher number of shoots per plant with the application of PSB as well as *Azotobactor* are also supported by Chhonkar *et al*. (2011) [4], Sarkar *et al.* (2011) [17], Nag (2006) [12] and Jatav *et al.*, (2013) [8].

Number of Branches per plant

During the first, second year and pooled mean data of the investigation at 60 DAP, the maximum number of branches per plant (7.16, 7.28 and 6.23) was observed under the treatment T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) which was statistically *at par* with the treatment T_2 (100% RDF through chemical fertilizer) having 6.40, 6.47 and 5.98 number of branches per plant respectively. Whereas, the minimum number of branches per plant (3.78, 3090 and 3.83) was recorded under T1 (control). At 75 DAP during first, and second year and pooled mean data, the maximum number of branches per plant (9.00, 9.43 and 9.22 respectively) were recorded under T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) which was found significantly better from rest of the treatments organic fertilizer with inorganic fertilizer and biofertilizer application in both years and pooled mean data. The minimum number of branches per plant was observed in Without NPK (Control) during both years as well as pooled data (5.76, 5.91 and 5.83) which were inferior to the rest of other treatments. The increased vegetative growth under these treatments might be due to the combination of inorganic fertilizer, organic matter with PSB and *Azotobactor*, which increased the availability of nutrients and provided the opportunity to enhance the number of branches per plant. A significant increase in the number of branches per plant recorded by the application of 50% FYM + Biofertilizer + 50% chemical fertilizer might be due to higher vegetative growth of the plant observed in those treatments. The above results are to the report of Kumar *et al*. (2013) [10] noticed the highest number of branches per plant under the biofertilizers (*Azotobactor* + PSB) combination.

Table 2: Plant emergence % of potato at 30 days after planting by different inorganic fertilizer, organic manure and biofertilizers

Treatments	Plant emergence (%)			Plant height (cm)								
				45 DAP			60 DAP			75 DAP		
	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean
T_1	90.64	91.94	91.29	31.22	32.06	31.64	39.08	39.76	39.42	40.91	41.57	41.24
T_2	96.69	97.69	97.19	39.34	40.73	40.03	45.67	46.43	46.05	47.67	49.61	48.64
T_3	95.36	96.68	96.02	37.12	37.72	37.42	42.40	43.08	42.74	44.89	46.74	45.81
T_4	95.70	97.00	96.35	38.92	39.83	39.37	43.16	43.83	43.49	46.25	48.62	47.43
T_5	94.95	95.35	95.15	34.95	35.46	35.21	40.88	41.70	41.29	41.85	42.81	42.33
T_6	97.46	98.54	98.00	40.75	42.02	41.39	46.76	46.95	46.86	49.62	51.43	50.52
T_7	94.74	95.28	95.01	35.69	36.55	36.12	41.26	41.74	41.50	43.19	45.35	44.27
T_8	93.54	94.14	93.84	34.19	34.81	34.50	40.49	41.15	40.82	42.76	43.49	43.12
T_9	92.47	93.21	92.84	32.39	33.45	32.92	39.94	40.62	40.28	41.52	42.38	41.95
SEm ±	1.36	1.42	1.31	2.03	2.12	1.96	1.44	1.45	1.37	1.84	1.99	1.81
CV	2.48	2.58	2.39	9.77	9.95	9.30	5.93	5.88	5.57	7.21	7.53	6.96
CD at 5%	NS	NS	NS	NS	NS	NS	4.33	4.36	3.92	5.53	5.97	5.19

Table 3: Number of shoots per plant and Number of branches at different growth stage of potato as influenced by inorganic fertilizers, organic manure and biofertilizers

Treatments	Number of shoots per plant						Number of branches per plant					
	45 DAP			60 DAP			60 DAP			75 DAP		
	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean
T_1	3.34	3.64	3.49	4.67	4.80	4.73	3.78	3.90	3.83	5.76	5.91	5.83
T_2	5.81	5.97	5.89	6.47	6.83	6.65	6.40	6.47	5.98	8.13	8.27	8.20
T_3	4.57	5.51	5.04	5.80	6.40	6.10	5.44	5.74	5.59	7.07	7.13	7.10
T_4	5.68	5.73	5.70	6.33	6.60	6.47	5.81	6.08	5.79	7.13	7.20	7.17
T_5	4.20	4.46	4.33	5.07	5.40	5.23	4.97	5.37	5.17	6.00	6.27	6.14
T_6	5.96	6.43	6.19	6.53	7.03	6.78	7.16	7.28	6.23	9.00	9.43	9.22
T_7	4.38	4.68	4.53	5.20	5.83	5.52	5.14	5.48	5.30	6.47	6.53	6.50
T_8	4.02	4.23	4.13	5.00	5.27	5.13	4.57	4.90	4.67	5.83	6.20	6.02
T_9	3.72	4.08	3.90	4.80	5.07	4.93	4.26	4.79	4.55	5.72	6.13	5.93
SEm ±	0.35	0.39	0.35	0.47	0.54	0.48	0.27	0.20	0.22	0.74	0.79	0.72
CV	13.15	13.74	12.71	14.54	15.84	14.38	8.75	6.31	7.44	18.79	19.57	18.10
CD at 5%	1.05	1.18	1.01	NS	NS	NS	0.80	0.61	0.64	NS	NS	NS

Table 4: Number of compound leaves per plant at different stages of potato as influenced by inorganic fertilizers, organic manure and biofertilizers

Treatments	Number of compound leaves per plant								
	45 DAP			60 DAP			75 DAP		
	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean
T_1	39.37	40.49	39.93	41.74	42.52	42.13	43.72	45.43	44.58
T_2	51.42	52.24	51.83	53.61	54.57	54.09	56.37	57.60	56.98
T_3	48.73	50.45	49.59	50.58	51.87	51.23	52.89	54.76	53.82
T_4	50.78	51.61	51.20	51.38	52.35	51.86	53.43	56.28	54.85
T_5	47.33	49.38	48.36	49.64	50.63	50.14	51.72	53.39	52.55
T_6	52.46	53.67	53.07	54.47	55.72	55.09	57.67	58.45	58.06
T_7	48.56	50.24	49.40	50.37	51.11	50.74	52.61	54.38	53.49
T_8	45.60	47.29	46.45	47.54	49.14	48.34	49.38	52.46	50.92
T_9	43.23	45.62	44.42	44.83	47.26	46.05	46.58	50.74	48.66
SEm ±	2.48	2.44	2.32	2.56	2.47	2.37	2.76	2.53	2.50
CV	9.04	8.61	8.32	8.98	8.45	8.21	9.28	8.15	8.21
CD at 5%	7.43	7.30	6.65	NS	NS	NS	NS	NS	NS

Table 5: Fresh weight, dry weight and dry matter content of potato shoots as influenced by inorganic fertilizers, organic manure and biofertilizers

Treatments	Fresh weight, dry weight and dry matter content of potato shoots per plant (gm)								
	Fresh weight			Dry weight			Dry matter content		
	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean	2018-19	2019-20	Pooled Mean
T_1	147.53	150.36	148.95	12.78	13.86	13.32	8.60	9.20	8.90
T_2	193.64	196.56	195.10	24.87	25.91	25.39	12.88	13.18	13.03
T_3	180.43	183.54	181.98	20.37	21.22	20.80	11.20	11.56	11.38
T_4	185.36	191.71	188.54	22.74	23.73	23.24	12.16	12.35	12.26
T_5	171.28	178.47	174.88	16.37	18.61	17.49	9.54	10.40	9.97
T_6	201.28	206.68	203.98	26.82	27.72	27.27	13.31	13.41	13.36
T_7	176.72	180.28	178.50	18.47	19.43	18.95	10.42	10.79	10.60
T_8	163.52	167.38	165.45	14.89	16.42	15.66	9.10	9.76	9.43
T_9	154.37	159.86	157.11	14.16	15.37	14.77	9.14	9.58	9.36
SEm ±	2.22	2.73	2.34	3.13	3.03	2.90	1.66	1.68	1.57
CV	2.20	2.63	2.29	28.46	25.90	25.60	26.87	26.07	24.95
CD at 5%	6.65	8.17	6.72	NS	NS	NS	NS	NS	NS

Number of compound leaves per plant

At 45 DAP during the first, second year and pooled mean data of investigation, the data clearly showed that the treatment T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) had the maximum number of compound leaves per plant (52.46, 53.67 and 53.07). On other hand, the minimum number of compound leaves per plant in both year and pooled mean (39.37, 40.49 and 39.93) was noted under the treatment in which no NPK (control) was applied. The data recorded for the number of compound leaves per plant indicated that organic fertilizer with inorganic fertilizer and biofertilizers had a significant effect at 60 DAP. During the first second year and pooled mean data of the investigation, the maximum number of compound leaves per plant (54.47, 55.72 and 55.09) was noticed under the treatment T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) and the minimum number of compound leaves per plant of both year and pooled mean (41.74, 42.52 and 42.13) was found in T_1 (control). At 75 DAP during both years and pooled mean of investigation, the data clearly that the treatment T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) had the maximum number of compound leaves per plant (57.67, 58.45 and 58.06). The minimum number of compound leaves per plant (43.72, 45.43 and 44.58) was noted under the treatment T_1 (Control) in both years and pooled mean. The FYM, as an organic manure source, may have aided in the development of soil physical properties such as porosity, aeration, and water-holding capacity. An application with *Azotobactor* and phosphobacteria would have played a role in the production of plant growth hormones and growth substances that influence plant growth, and therefore the number of compound leaves may have been influenced, which is an important constituent of plant growth. Similarly, Nag (2006) [12] also found the highest number of compound leaves per plant with the application of crop residue incorporation with biofertilizers (PSB + *Azotobactor*) at different growth stages of the potato crop. Thus, it is clear from the findings of this investigation that all the treatments had an equal potential to produce leaves. Similar results have also been reported by Verma *et al*. (2011) [19], Kumar *et al* (2020) [11] and Chaudhary *et al*. (2022) [3] in potato.

Fresh weight of potato shoots per plant (g)

Treatment of data revealed that the fresh weight of shoots per plant was significantly influenced by the different uses in the present study. T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) recorded the maximum fresh weight of shoots per plant (201.28g, 206.68g and 203.98g) in the first year, second year and pooled mean data, which was followed by T_2 *i.e.* 100% RDF through chemical fertilizer (193.64g, 196.56g and 195.10g) and T_4 *i.e.* FYM + 50% chemical fertilizer (185.36g, 191.71g and 188.54g) respectively. The lowest fresh weight of shoots per plant was noted in treatment T_1 (control) at 147.53g, 150.36g and 148.95g. The findings of the current study show an increase in the fresh weight of shoots plant^{-1} at all growth stages because the plant had more

vegetative growth with the optimum levels of FYM and high fertility levels, which may have been associated with an acceleration of a high rate of photosynthesis. Verma *et al.* (2011) [19] observed that crop residues + *Azotobacter* + phasphobacteria + biodynamic approach + microbial culture resulted in the highest fresh weight of shoots. These findings are also supported by potato research conducted by Chhonkar *et al*. (2011) [17], and Sarkar *et al*. (2011) [17].

Dry weight of potato shoots per plant (g)

During the first year, second year and pooled mean data of the present investigation, the maximum dry weight of shoots per pant (26.82g, 27.72g and 27.27g) was observed under T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) which was followed by T_2 *i.e.* 100% RDF through chemical fertilizer (24.87g, 25.92g and 25.39) and T_4 *i.e.* FYM + 50% chemical fertilizer (22.74g, 23.73g and 23g) having a dry weight of shoots per plant. The minimum dry weight of shoots per plant (12.78g, 13.86g and 13.32g) was recorded under the treatment T_1 (control) followed by T_9 *i.e.* 50% vermicompost + biofertilizer during the first year, second year and pooled mean data. Better shoot growth in terms of dry weight under organic manure applications could be attributed to increasing nutrient availability at the crop's peak requirement. Singh and Gupta also reported similar findings (2005). The highest shoot growth was obtained by combining 75% RDF + 8 t vermicompost ha^{-1}+*Azotobactor* + Phosphorus solubilizing bacteria, as reported by Nag (2006) observed that crop residue incorporation with biofertilizers (PSB + *Azotobacter)* resulted in the highest dry weight of shoots per plant in potato.

Dry matter content of potato shoots per plant

Observation recorded during first year, second year and pooled mean data, clearly showed that the treatment T_6 (50% FYM + Biofertilizer + 50% chemical fertilizer) had the maximum dry matter content (%) of shoots (13.31, 13.41 and 13.36) which was followed by T_2 *i.e.* 100% RDF through chemical fertilizer (12.88, 13.18 and 13.03) and T_4 *i.e.* FYM + 50% chemical fertilizer (12.16, 12.35 and 12.26) respectively. The minimum dry matter content of shoots was noticed under the treatment T_1 (control) during the first year, and second years as well as pooled mean data (8.60, 9.20 and 8.90). The recent findings of this study indicate an increase in the dry matter content of shoots $plant^{-1}$ at all growth stages because the optimum level of FYM, combined with high fertility levels and biofertilizer application, resulted in more vegetative growth, which may be contributed to an acceleration of the high rate of photosynthesis. Similar results had also been reported by Nag (2006) [12].

Reference

1. Anonymous Directorate of Horticulture, Govt. of Chhattisgarh, Raipur; c2019.
2. Anonymous. National Horticulture Board, Dept. of Agri. Coop. & Farmers Welfare, Government of India; c2019.
3. Chaudhary A, Rawat M. Response of Potato (*Solanum tuberosum* L.) to Integrated Nutrient Management in Sandy Loam Soils of Punjab. Biological Forum – An International Journal. 2022;14(1):1235-1240.
4. Chhonkar DS, Kumar P, Shroti SK. Efficacy of bio fertilizers in potato (*Solanum tuberosum* L.). Annals of Horticulture. 2011;4(2):197-201.
5. Densilin DM, Srinivasan S, Manju P, Sudha S. Effect of individual and Combined Application of Biofertilizers, Inorganic fertilizer and Vermicompost on the Biochemical Constituents of Chilli (Ns-1701). Journal Biofertilizers & Biopesticides. 2010;2:104.
6. Dev A, Kumar S, Kumar D, Patel VK, Kumar A, Sahu RK, *et al*. The Effect of Integrated Nutrient Management (INM) and Zn Fertilization on Yield of Potato. Int. J Curr. Microbiol. App. Sci. 2020;9(4):1518-1526.
7. Jaipaul Sharma S, Sharma AK. Effect of organic fertilizers on growth, yield and quality of potato under rainfed condition of central Himalayan region of uttarakhand. Potato J. 2011;38(2):176-181.
8. Jatav MK, Kumar M, Trehan SP, Dua VK, Kumar S. Effect of nitrogen and varieties of potato on yield and agronomic n use efficiency in north-western plains of India. Potato J. 2013;40(1):55-5.
9. Khurana PSM, Naik PS. The potato: an overview In: the potato production and Utilization in sub-tropics (Edited by S.M. paul khurna, J.S. Minas and S.K. Pandey) Mehta Publication, New Delhi; c2003. p. 1-14.
10. Kumar M, Baishaya LK, Ghosh DC, Gupta VK, Verma MR. Effects of organic manures, chemical fertilizers and biofertilizers on growth and productivity of rainfed potato in the eastern Himalayas. Journal of plant nutrient. 2013;36:1065-1082.
11. Kumar V, Singh JP, Shivani, Kaushik H. A Study of Vermicompost, Cow Dung and Phosphate Solubilizing Bacteria on Growth and Yield of Potato (*Solanum tuberosum* L). Int. J Curr. Microbiol. App. Sci. 2020;9(8):184-189.
12. Nag GP. Integrated nutrient management in potato for Chhattisgarh plain. M.Sc. (Ag) Thesis IGKV, Raipur; c2006. p. 94-95.
13. Pal KK, Gardener M. Biological Control of Plant Pathogens. American Journal of Plant Sciences. 2006, 6(10).
14. Patel B. Effect of different levels of NPK on growth, development and yield of potato cv. Kufri Ashoka under Chhattisgarh condition. Msc. (Ag) Thesis IGKV, Raipur; c2013. p. 70-71.
15. Raghav M, Kumar T, Kamal S. Effect of organic sources on growth, yield and quality of potato. Anna. Horti. 2008;1(1):67-70.
16. Scott GJ, Suarez V. Growth rates for potato on India and their implications for industry. Potato J. 2011;38(2):100-112.
17. Sarkar A, Sarkar S, Zaman A. Growth and yield of potato as influenced by combination of organic manures and inorganic fertilizers. Potato Journal. 2011;38(1):78-80.
18. Singh SK, Gupta VK. Influence of farm yard, nitrogen and biofertilizer on growth, tuber yield of potato under rainfed condition in East Khasi Hill District of Meghalaya. Agricultural Science Digest. 2005;25(4):281-283.
19. Verma Satish K, Asati BS, Tamrakar SK, Nanda HC, Gupta CR. Effect of organic components on growth, yield and economic returns in potato. Potato J. 2011;38(1):51-55.
20. Yadav SK, Srivastava AK, Bag TK. Effect of integrated nutrient management on production of seed tubers from true potato (*Solanum tuberosum* L.) seed. Ind. J Agro. 2014;59(4):646-650.