www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(2): 06-09

www.thepharmajournal.com
Received: 04-12-2021
Accepted: 06-01-2022

Monika
Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, Haryana, India

Makhan Lal
Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, Haryana, India

Amit Verma
Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, Haryana, India

Khyati Singh
Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, Haryana, India

Tejinder Singh
Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, Haryana, India

Corresponding Author
Amit Verma
Department of Vegetable Science, CCS Haryana Agricultural University, Hisar, Haryana, India

Effect of manure and biofertilizers on growth and yield parameters of carrot seed crop in Northern plains of India

Monika, Makhan Lal, Amit Verma, Khyati Singh and Tejinder Singh

Abstract
An experiment was conducted at Seed Research Area of Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar during spring-summer season of 2019-20. The objectives of the investigation were to study the effect of manure and biofertilizers on growth and seed yield parameters of carrot seed crop. The experiment involved fourteen treatments, *viz*., T1- Absolute control, T2- RDF (N:P:K 80:40:40 kg/ha), T3- Farm yard manure 25t/ha, T4- Poultry manure 4t/ha, T5- Vermicompost 8t/ha, T6- FYM 12.5t/ha+ PM 2t/ha, T7- FYM 12.5t/ha+ PM 2t/ha, T8- FYM 12.5t/ha+ PM 2t/ha+ VC 4t/ha, T9- FYM 12.5t/ha+ PM 2t/ha+ *Azo+PSB*, T10-FYM 12.5t/ha+ *Azo+PSB*, T11- FYM 12.5t/ha+ VC 4t/ha+ *Azo+PSB*, T12- VC 8t/ha+ *Azo+PS*B, T13- PM 4t/ha+ *Azo+PS*B and T14- FYM 12.5t/ha+ PM 2t/ha+ VC 4t/ha + *Azo+PSB* and was laid out in Randomized Block Design with three replications. Maximum plant growth, seed yield and yield attributing characters, *viz*., Sprouting percentage, days to 50% sprouting, plant height, umber of secondary umbels, number of umblets per umbel, number of seeds per umbel, number of seeds per umblets, seed yield/umbel (g) and seed yield (q ha^{-1}) of carrot cv. Hisar Gairic was obtained with treatment T14 having combination of all the three manure and biofertilizers (FYM 12.5t/ha+ PM 2t/ha+ VC 4t/ha+ *Azo+PSB)*, which was found at par with treatments T8, T9, T11 and T2. Hence, application of farm yard manure @ 12.5 t/ha along with poultry manure @ 2 t/ha and vermicompost @ 4t/ha + Azo+ PSB is recommended of carrot seed production in northern plains of India.

Keywords: biofertilizers, carrot, manures, seed production, steckling

1. Introduction
Carrot (*Daucus carota var. atrorubens*) belonging to family *Umbelliferae* with chromosome number 2n=18 is a popular cool season vegetable root crop. It is grown throughout the world, in temperate countries mainly during spring and summer season, while in tropical regions, during winter season. The area under carrot crop in India is reported to be 1.09 lakh ha with an annual production of 18.93 lakh metric tonnes (Anonymous, 2019) [2]. Uttar Pradesh, Assam, Karnataka, Andhra Pradesh, Punjab and Haryana are the important growing states in India. In one season, it produces high quality edible root and in two seasons, produces seeds. Its cultivated forms have been domesticated from wild species. Carrot is cultivated in some countries for its seed, which is the source of essential carrot seed oil. Carrot is grown from seeds and its successful production depends upon a good quality. The vegetable crops are more remunerative, thus, the area under vegetable crops is increasing every year. Simultaneously, the demand for quality seed is increasing gradually. The most compelling reason for using organic seed when growing organic crops is that seed produced organically causes less chemical impact on the atmosphere. During organic seed production, soil fertility and pest management is achieved through cropping patterns, organic manure, biofertilizers, cultural practices and biopesticides, together with plant derived products. Seed produced organically will produce plants that are more adapted to or more likely to thrive under organic growing conditions. This increase in demand will lead to improvement in variety selection & development and increased availability of more organic seed. Biofertilizers are the products containing one or additional species of microorganisms which have the ability to mobilize nutritionally important elements. Regular addition of organic materials, particularly the composted ones, increases soil physical fertility, mainly by improving aggregate stability and decreasing soil bulk density. FYM being a bulky organic material releases the soil compaction and improves the aeration additionally to the provision of essential plant nutrients and organic matter, thereby increasing the soil microbial establishment together with the build-up of additional humus content.

Vermicompost is an organic fertilizer produced by biological processing of organic feed by earthworms. Poultry Manure and Poultry litter are by far the largest waste products from the poultry industry and are commonly used as source of nutrients for crop production and total N and P contents in poultry wastes are among the highest of all the wastes. Keeping in view the above stated facts, the experiment was carried out to study the effect of manures and biofertilizers on growth and yield parameters of carrot seed crop.

2. Materials and Methods

The present study was conducted at Seed Research Area of Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar (29°09'N and 75°43'E, elevation 215 m) during spring-summer season of 2019-20. The experiment involved fourteen treatments, *viz*., T1- Absolute control, T2- RDF (N:P:K 80:40:40 kg/ha), T3- Farm yard manure 25t/ha, T4- Poultry manure 4t/ha, T5- Vermicompost 8t/ha,T7- FYM 12.5t/ha+ PM 2t/ha, T8- FYM 12.5t/ha+ PM 2t/ha+ VC 4t/ha, T9- FYM 12.5t/ha+ PM 2t/ha+ *Azo+PSB*, T10-FYM 12.5t/ha+ *Azo+PSB*, T11- FYM 12.5t/ha+ VC 4t/ha+ *Azo+PSB*, T12- VC 8t/ha+ *Azo+PS*B, T13- PM 4t/ha+ *Azo+PS*B and T14- FYM 12.5t/ha+ PM 2t/ha+ VC 4t/ha + *Azo+PSB* and was laid out in Randomized Block Design with three replications. The crop was sown on 8th October, 2019. All recommended package of practices were followed uniformly as per the crop requirements. Observations were recorded for different growth and yield parameters, *viz*., sprouting (%), days to 50% sprouting, plant height (cm) at 30, 60, 90 DAP & final harvest, number of secondary umbels/plant, number of umblets/umbel, number of seeds/umblets, number of seeds/umbel, seed yield/umbel (g) and seed yield (q ha^{-1}). The crop was harvested manually on 1st June, 2020. Statistical analysis of experimental data was conducted using the OPSTAT software package.

3. Results and Discussion

In the present study, manures and biofertilizer showed no significant effect on sprouting percentage and days to 50% sprouting (Table 1). This might be due to the fact that manure are not utilized immediately rather they are made available to the plant slowly and that is why no impact of manure and biofertilizer was seen on this parameter. These results are in agreement with the findings of Nagarajana and Pandita, 2001 [12] in carrot and Makhan Lal, 2005 [10] in onion, guar and potato.

The growth parameters like plant height varied significantly with combined application of manure and biofertilizers. Plant growth parameters responded positively to combination of organic fertilizers and biofertilizers compared with plants not supplied with any of the fertilizer. Plant height at 30, 60, 90 days after steckling planting and at final harvest were recorded maximum in treatment T14 which was supplied with FYM 12.5t/ha+ PM 2t/ha+ VC 4t/ha + *Azo+PSB* and it was at par with treatments T8 (FYM 12.5t/ha+ PM 2t/ha+ VC 4t/ha), T9 (FYM 12.5t/ha+ PM 2t/ha+ *Azo+PSB)*, T11 (FYM 12.5t/ha + VC 4t/ha+ *Azo+PSB)* and T2 [RDF (N:P:K 80:40:40 kg/ha)], while, minimum was observed with the control treatment. This finding is (Table 1) in collaboration with the results obtained by Haidar *et al.*, 2012 [7] who stated that organic manure treatments are better with respect to growth of carrot seed crop as compared to control treatment (no application of manure and biofertilizers).

Carrot seed plants responded positively to combination of all the manures (poultry manure, vermicompost and farmyard manure) and biofertilizers (*Azotobacter* and *Phosphobacterium*). The significant increase in growth attributes may also be due to the action of applied manures which contained all the macronutrients and most of the micronutrients which are needed for the crop growth which results in improvement in soil structure and increased nutrient and moisture availability and uptake that may have boosted up the growth of the plant and thereby ameliorate the plant architecture by enhancement in the number of branches per plant and also due to the ability of biofertilizers to increase in availability of N through biological N fixation and P and produce ammonia, vitamins and plant growth substances like IAA (auxins), gibberelins and cytokinins and greater availability of phosphorus by *Phosphobacteria*, Bhattacharya *et al.*, 2002 [4], which helped the plants in better nutrient absorptions as reported by Shende *et al*., 1973 [14] which resulted in gradual increase in plant height. Similiar findings were reported by Vithewal and Kanaujia, 2013 [15], who stated that organic manures along with biofertilizers have significant effect on carrot growth, Mbatha *et al*., 2014 [11], Kumar *et al*., 2017 [9] and Roshni *et al*., 2019 [13] in carrot.

Maximum number of seeds per primary & secondary umblets and number of seeds per primary & secondary umbel were recorded in treatment T14 which was at par with treatments T8, T9, T11 and T2, while, lowest was recorded in control treatment (Table 2). The synergistic impact of combined use of manure along with biofertilizers increased the availability of essential nutrients in sufficient amount, increased the concentration of carbohydrates in seed which act as a stock of carbohydrates. This might have resulted in increased number of seeds per umblets and hence number of seeds per plant. The results are supported with the findings of Ahamed, 1999 [1] in black gram, Bendegumbal *et al*., 2008 [3] who stated that combined application of manure and biofertilizers enhanced the number of umbels per plant in onion crop.

The seed yield parameters, *viz*., seed yield per primary & secondary umbel, seed yield per primary & secondary umblets and seed yield per hectare were recorded to evaluate the impact of different manure and biofertilizer in carrot seed crop. In the present study, the better performance of individual plants with respect to seed yield under treatment T14 is directly related to the higher number of umblets per umbel, number of primary umbels per plant and number of secondary umbels per plant and was found to be significantly influenced by manures and biofertilizers. This might be due to the fact that the availability of appropriate amount of essential plant nutrients from organic source, balanced C:N ratio, synthesis of auxin, growth substances and transformation of insoluble phosphate to soluble form by Phosphorous Solubilizing Bacteria (*PSB*) possibly helped to increase the seed yield of carrot. Minimum seed yield was recorded in control where neither organic manure nor biofertilizer was applied which might be due to unavailability of required amount of nutrients for plants to complete their reproductive phase. The results are in accordance with the earlier findings of Ahamed, 1999 [1] in black gram. In addition to these factors, yield attributing characters may be reasoned to such results. Similarly Jayathilake *et al*., 2003 [8] obtained highest bulb yield (22.4%) with application of *Azosprillum*+ vermicompost+ chemical fertilizers.

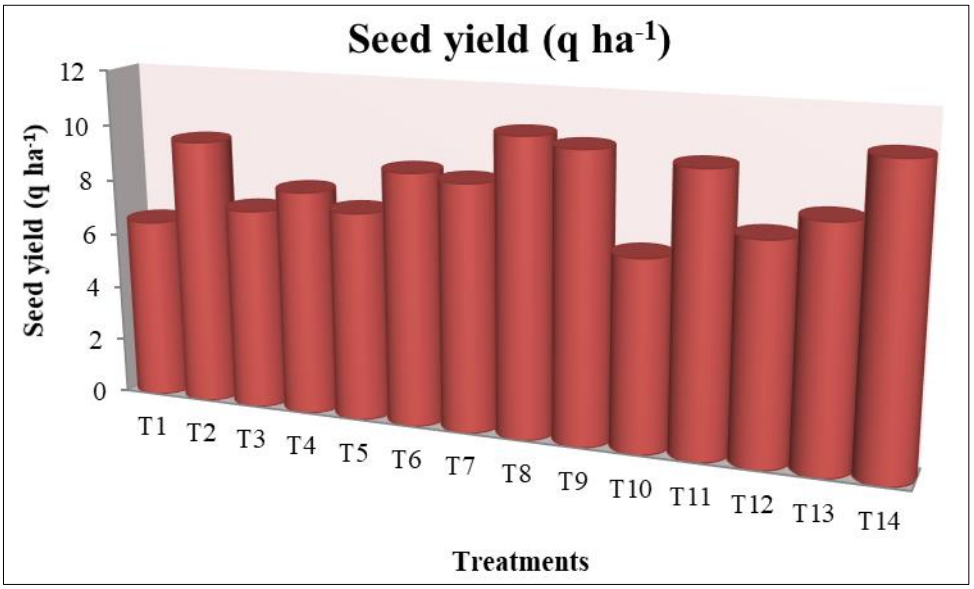

Fig 1: Effect of different treatment combinations on seed yield (q ha^{-1}) of carrot seed crop

The significant increase in seed yield (q ha^{-1}) with the treatment T14 which was at par with treatments T8, T9, T11 and T2 (Fig. 1) may be explained on the basis of better crop growth, increase in primary and secondary umbel seeds with the application of manure and biofertilizers. The availability of additional nitrogen under *Azotobacter* treatments could also be the reason for better plant growth and thereby yield. Seed yield is directly dependent on the performance of yield attributes and a perusal of data pertaining to growth of the yield attributes revealed that application of T14 (FYM 12.5t/ha+ PM 2t/ha+ VC 4t/ha + *Azo+PSB)* was sufficient for carrot seed production. Duncan, 2005 [5] stated that poultry manure was an organic manure that provides all the macronutrients and almost micronutrients that are needed for the plant growth and FYM appears to act directly by enhancing the crop yield either by hastening the respiratory processes through cell permeability or by hormone growth action. It supplies nitrogen, phosphorus and sulphur in available forms to the plants through biological decomposition. Similar findings were also reported from vermicompost application which act as chelating agent and directed the availability of micronutrients to plants there by increased growth and yield by providing nutrients in available form (Giraddi, 1993) [6]. A viable combination of manure and biofertilizers would cause synergistic effect in the nutrient uptake and provide better development of the economic part (seed) and also lead to the increased soil area scrutinized by the plant thus increase the seed yield attributes. Favourable environment interaction of manure and biofertilizers might have helped in the development of new tissue and expansion of new shoot which resulted in increased growth and seed yield attributes of the crop.

Table 1: Effect of manures and biofertilizers on sprouting (%), days to 50% sprouting, plant height at 30, 60, 90 DAP and final harvest, number of secondary umbels/plant and number of umblets/umbel

Treatments	Sprouting (%)	Days to 50% sprouting	Plant Height (cm) (Days after planting)				Number of secondary umbels/ plant	Number of umblets/umbel	
			30	60	90	Final Harvest		Primary	Secondary
T1	96.37	12.45	17.46	96.20	130.80	133.04	8.40	45.20	39.20
T2	96.87	11.89	23.20	111.15	149.54	151.45	10.11	57.26	47.00
T3	98.43	12.35	19.53	99.93	138.73	140.97	8.75	47.83	40.83
T4	96.87	12.32	21.26	105.93	143.06	144.53	9.28	52.80	43.10
T5	96.87	12.45	20.20	103.26	140.93	142.40	8.97	48.60	41.17
T6	98.43	11.91	22.80	108.66	146.20	148.02	9.89	56.30	45.83
T7	98.43	12.02	22.53	108.00	144.86	146.06	9.71	56.10	44.70
T8	99.47	11.22	24.86	113.06	152.93	154.72	10.68	58.60	50.58
T9	98.93	11.45	24.13	112.26	151.34	154.42	10.44	58.23	49.37
T10	96.87	12.32	18.86	98.93	136.26	137.94	8.53	46.60	40.00
T11	99.47	11.78	23.80	111.26	149.84	152.08	10.30	57.43	47.20
T12	96.87	12.33	21.20	105.00	142.86	144.30	9.15	50.00	42.70
T13	96.87	12.28	21.60	106.60	143.80	146.04	9.54	54.17	43.27
T14	99.47	11.00	26.46	114.93	153.26	156.84	10.91	59.23	52.50
C.D. at 5%	NS	NS	3.26	3.79	3.82	3.76	0.52	1.98	1.94

(T1= Absolute control; T2= Recommended dose of fertilizers (N:P:K 80:40:40 kg/ha); T3= FYM 25t/ha; T4= Poultry manure 4t/ha; T5= Vermicompost 8t/ha; T6= FYM 12.5t/ha+ poultry manure 2t/ha; T7= FYM 12.5t/ha+ vermicompost 4t/ha; T8= FYM 12.5t/ha+ poultry manure 2t/ha+ vermicompost 4t/ha; T9= FYM 12.5t/ha+ poultry manure 2t/ha+ *azotobacter*+ *phosphobacteria*; T10= FYM 12.5t/ha+ *azotobacter*+ *phosphobacteria*; T11= FYM 12.5t/ha+ vermicompost 4t/ha+ *azotobacter*+ *phosphobacteria*; T12= Vermicompost 8t/ha+ *azotobacter*+ *phosphobacteria*; T13= Poultry manure 4t/ha+ *azotobacter*+ *phosphobacteria*; T14= FYM 12.5t/ha+ Poultry manure 2t/ha+ vermicompost 4t/ha+ *azotobacter*+ *phosphobacteria)*

Table 1: Effect of manures and biofertilizers on number of seeds/umblets, number of seeds/umbel, seed yield/umbel (g) and seed yield (q ha^{-1})

Treatments	Number of seeds /umblets		Number of seeds/umbel		Seed yield/ umbel (g)		Seed yield (q ha^{-1})
	Primary	Secondary	Primary	Secondary	Primary	Secondary	
T1	42.23	29.60	1,909.00	1,160.14	2.48	1.28	6.53
T2	49.67	33.01	2,899.64	1,720.83	3.07	1.72	9.60
T3	46.07	30.03	2,200.44	1,222.92	2.63	1.37	7.26
T4	47.37	30.43	2,500.31	1,312.28	2.74	1.47	8.09
T5	46.30	30.23	2,249.36	1,245.36	2.64	1.40	7.51
T6	48.53	31.8	2,732.45	1,657.07	2.92	1.60	9.07
T7	48.30	30.63	2,708.55	1468.71	2.89	1.55	8.86
T8	49.90	34.43	2,924.39	1,789.79	3.17	1.78	10.60
T9	49.87	34.33	2,901.96	1,760.42	3.15	1.75	10.29
T10	43.10	29.66	2,007.36	1,185.85	2.56	1.32	6.82
T11	49.73	33.53	2,900.60	1,740.24	3.09	1.74	9.94
T12	47.17	30.36	2,357.14	1,297.91	2.69	1.43	7.79
T13	47.47	30.50	2,570.45	1,320.67	2.80	1.52	8.54
T14	50.97	34.70	3,019.74	1,820.94	3.19	1.81	10.68
C.D. at 5%	1.49	1.71	120.21	110.11	0.15	0.10	1.25

(T1= Absolute control; T2= Recommended dose of fertilizers (N:P:K 80:40:40 kg/ha); T3= FYM 25t/ha; T4= Poultry manure 4t/ha; T5= Vermicompost 8t/ha; T6= FYM 12.5t/ha+ poultry manure 2t/ha; T7= FYM 12.5t/ha+ vermicompost 4t/ha; T8= FYM 12.5t/ha+ poultry manure 2t/ha+ vermicompost 4t/ha; T9= FYM 12.5t/ha+ poultry manure 2t/ha+ *azotobacter*+ *phosphobacteria*; T10= FYM 12.5t/ha+ *azotobacter*+ *phosphobacteria*; T11= FYM 12.5t/ha+ vermicompost 4t/ha+ *azotobacter*+ *phosphobacteria*; T12= Vermicompost 8t/ha+ *azotobacter*+ *phosphobacteria*; T13= Poultry manure 4t/ha+ *azotobacter*+ *phosphobacteria*; T14= FYM 12.5t/ha+ Poultry manure 2t/ha+ vermicompost 4t/ha+ *azotobacter*+ *phosphobacteria)*

4. Conclusion

On the basis of this experiment, it may be concluded that application of farm yard manure @12.5 t/ha along with poultry manure @ 2 t/ha and vermicompost @ 4t/ha + Azo+PSB is better for growth and yield parameters than other treatments for carrot seed production in northern plains for India.

Acknowledgments

Thanks are due to Chaudhary Charan Singh Haryana Agricultural University, Hisar for providing financial assistance.

References

1. Ahamed AS. Effect of seed pelleting of field performance of blackgram. Legum Res. 1999;22:109-112.
2. Anonymous. Indiastat focused on facts (2018-19). indiastat.com, 2019.
3. Bendegumbal SC, Ashok SS, Vyakaranahal BS, Malbasari TA, Hosamani RM, Patil AB. Studies on organic seed production in onion (*Allium cepa* L.) J Agric Sci. 2008;21:120-121.
4. Bhattacharya P, Jain RK, Paliwal MK. Biofertilizers for vegetables. Indian Hort. 2000;44:12-13.
5. Duncan J. Composting chicken manure. WSU Cooperative Extension, King County Master Gardener and Cooperative Extension Livestock Advisor. Washington State University, Pullman (USA), 2005.
6. Giraddi RA. Vermiculture and its role in agriculture. In: Proc., course on the officers of the state department of agriculture, Karnataka by the Department of Agriculture microbiology, University of Agricultural Sciences, Dharwad, Karnataka (India), 1993, 50-54.
7. Haidar SMZ, Nannnan MN, Hossain MM. Effect of organic manures on the seed production of carrot. Bangladesh J Crop Sci. 2012;22-23:111-115.
8. Jayathilake PKS, Reddy IP, Srihari D, Reddy KR, Neeraja G. Integrated nutrient management in onion (*Allium cepa* L.). J Trop Agric. 2003;15:1-9.
9. Kumar A, Batra VK, Panghal VPS, Malik A. Effect of FYM and gypsum on economics of carrot seed production under high residual sodium carbonate of water. Bhartiya Krishi Anusandhan Patrika. 2017;32:273-275.
10. Lal Makhan. Response of potato, onion and guar grown to sequence to organic manure and biofertilizers. Ph.D. Thesis submitted to CCS Haryana Agricultural University, Hisar (Haryana), 2005.
11. Mbatha AN, Ceronio GM, Coetzer GM. Response of carrot (*Daucus carota* L.) yield and quality to organic fertiliser. S Afr J Plant Soil. 2014;31:1-6.
12. Nagarajana S, Pandita VK. Effect of umbel shape on root characters and subsequent seed yield in Asiatic carrot (*Daucus carota*). Indian J Agric Sci. 2001;71:98-101.
13. Roshni P, Murthy N, Jyothi KU, Suneetha DRS. Studies on influence of biofertilizers and NPK on nutrient uptake and production economics of carrot. Int J Chem Stud. 2019;7:395-398.
14. Shende ST, Arora CK, Sen A. Interaction between *Azotobacter chroococcum*, *Bacillus megaterium* var. *phosphaticum* and *Rhizobium* sp. Zbl Bakt Abt II Bd, Indian Agricultural Research Institute, Division of Microbiology, New Delhi (India). 1973;128:668-677.
15. Vithewal and Kanaujia. Integrated nutrient management on productivity of carrot and fertility of soil. SAARC J Agri. 2013;11:173-181.