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Effect of Different Fertilizer Levels and Biostimulants on Growth and Yield of Cabbage (*Brasssica oleracea* var. *capitata*)

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ABSTRACT: A field experiment was carried out on Golden Acre during rabi season of 2021-22 and 2022-23 at College farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat, India. Now a days directly organic farming is not affordable to the grower so we have to go on integrated concept of farming. Present investigation comprising three factors *viz.*, three levels of fertilizer *viz.*, 60 % RDF (f_1), 80 % RDF (f_2) and 100 % RDF (f_3), biostimulant with three levels *viz.*, *Jeevamrut* (b_1), Vermiwash (b_2) and Bio NPK Consortium (b_3) and three levels of novel organic liquid nutrient *viz.*, 1.0 % (n_1), 1.5 % (n_2) and 2.0 % (n_3). Thus, there were total 27 treatment combinations under studyAmong three fertilizer levels of chemical source application of 100% RDF (f_1) helped in obtaining maximum values for growth parameters *viz.*, plant height at 30 DAT (cm), plant height at harvest (cm), number of leaves per plant at harvest while, minimum days taken for initiation of head after transplanting, days taken for edible maturity of head after transplanting and maximum value of yield parameters *i.e.*, average weight of head (g), yield per plot (kg), yield per hectare (t). Among three biostimulants application of *jeevamrut* (b_1)showed maximum values for growth parameters *viz.*, plant height at harvest (cm), number of leaves per plant at harvest, yield parameters *i.e.*, average weight of head (g), yield per plot (kg), yield per hectare (t)and among three different novel culture application of novel organic liquid nutrient @ 2.0 % (n_3)showed maximum values for growth parameters *viz.*, plant height at harvest (cm), number of leaves per plant at harvest, yield parameters *i.e.*, average weight of head (g), yield per plot (kg), yield per hectare (t). While, interaction effect between fertilizer levels and biostimulant (f × b) shows significantly maximum plant height at harvest (cm), number of leaves per plant at harvest, average weight of head (g), yield per plot (kg) and yield per hectare (t) with the treatment combination of 100 % RDF + *jeevamtut* (f_3b_1).

Keywords: Cabbage, Biostimulant, *Jeevamrut*, Vermiwash, Bio NPK Consortium, novel organic liquid nutrient.

INTRODUCTION

Cabbage is one of the important leafy vegetable crops and used as salad, cooked, pickling as well as dehydrated vegetable. The word "Cabbage" is derived from the French word "coboche" means head. The cabbage belongs to brassicaceae family. The particular flavor in the cabbage head is due to the glycoside 'sinigrin' which contain sulphur. The cabbage head is rich source of vitamin A, B, C and also contains minerals. It has cooling effect and helps in preventing constipation, increase appetite, speed up digestion and very useful for patients of diabetes (Patel *et al.*, 2018).

India ranks second next to China in cabbage production (Singh *et al.*, 2021). In India, cabbage is cultivated in about an area of 413.0 thousand hectares with the production 9606 MT and the productivity of 23.27 t/ha. The major cabbage growing states in India are Gujarat, U.P., Orissa, W.B., Assam, Maharashtra and Karnataka. In Gujarat, cabbage crop is cultivated in almost all the districts with major cultivation in Bhavnagar, Anand, Kheda, Junagadh, Sabarkantha, Banaskantha and Ahmedabad. In Gujarat, it is cultivated in about an area of 37.40 thousand hectares with an annual production of 796.73 MT having productivity of 21.30 t/ha (Anonymous, 2021).

Now a days use of organic nutrients in vegetable crops is a common trend and it increases crop yield without any adverse effects on the environment and soil. The organic manures are bulky in nature but, contain reasonable amount of nutrients. The supply of nutrients through organics alone has failed to maintain yield level in a short period. With the integrated cultivation use of combined application of chemical fertilizers with

organics such as FYM, compost, green leaf manure, vermicompost etc. and liquid organics *viz*., *Jeevamrut*, *Beejamrut*, *Panchagavya*, *Gomutra*, *Angara*, Vermiwash *etc*., which contain microbial count and plant growth promoting substances through stimulate growth, yield and quality of crops. Further, it helps to build soil organic matter status besides minimizing the cost of cultivation.

Biostimulants are natural substances derived from plants and animals that stimulate plant processes at very low concentrations. When applied to the plants and have been found to influence plants metabolic processes such as respiration, photosynthesis, nucleic acid synthesis and ion uptake (Khan *et al.,* 2009). It is an organic products composed of peptides, amino acids, polysaccharides, humic acids and phytohormones for immediate uptake and availability within the plant. They are also claimed to enhance crop growth and yield through a series of widely varying mechanisms including activation of soil microbial activity and promotion or augmentation of the activities of critical soil enzymes or plant growth hormones (Parrado *et al.*, 2008).

MATERIAL AND METHODS

The field experiment entitled was carried out at College farm, College of Horticulture, S. D. Agricultural University, Jagudan, Distt. Mehsana (Gujarat), India during *rabi* season of 2021-22 and 2022-23. Present investigation comprising of three factors *viz.,* three levels of fertilizer *viz.,* 60 % RDF (f_1), 80 % RDF (f_2) and 100 % RDF (f_3), biostimulant with three levels *viz.*, *Jeevamrut* (b_1), Vermiwash (b_2) and Bio NPK Consortium (b_3) and three levels of novel organic liquid nutrient *viz.,* 1.0 % (n_1), 1.5 % (n_2) and 2.0 % (n_3). Thus, there were total 27 treatment combinations under study. Inorganic fertilizer like NPK applied as per treatment, among them one third dose of N and full dose of P & K was applied at transplanting as basal dose. Remaining dose of N was applied as per treatment into two equal splits through top dressing at 20 and 40 DAT. *Jeevamrut* was applied in soil through drenching @ 500 l/ha at 15, 30, 45 and 60 DAT. Vermiwash (1:5 times dilution) was sprayed at 30 and 45 DAT. Bio NPK consortium was applied in soil @ 2.5 l/ha at the time of transplanting mix with required quantity of water (500 l/ha). Novel organic liquid nutrient was sprayed as per treatment (1.0 %, 1.5 % and 2.0 %) at 20 and 40 DAT.

Seedling of variety Golden Acre were transplanting in October, 2021-22 and 2022-23 at a spacing of 30 cm ×30 cm in a plot having dimensions of 2.70 m × 1.50 m. The experiment was laid out in Randomized Block Design with factorial concept with three replications. Other cultural practices and plant protection measures were taken as per recommendations. The data on plant height at 30 DAT and at harvest (cm), leaf area at 45 DAT (cm^2), days taken for initiation of head after transplanting, days taken for edible maturity of head after transplanting, number of leaves per plant at harvest, stem diameter at harvest (cm), average weight of head (g), yield per plot (kg) and yield per hectare (t)were recorded from randomly selected five plants in each plot. The data were analysed statistically by adopting the standard procedures described by Panse and Sukhatme (1985).

RESULT AND DISCUSSION

Effect on growth parameters. The different growth parameters *viz.,* plant height at 30 DAT and at harvest (cm), number of leaves per plant at harvest, days taken for initiation of head after transplanting, days taken for edible maturity of head after transplanting, leaf area at 45 DAT (cm^2) and stem diameter at harvest (cm) were recorded.

Effect of different fertilizer levels. An assessment of data (Table 1) indicated that significantly maximum plant height at 30 DAT and at harvest (20.83 cm and 24.13 cm during 2021-22, 20.92 cm and 24.60 cm during 2022-23 and 20.88 cm and 24.37 cm in pooled) respectively, number of leaves per plant at harvest (14.56, 14.81 and 14.68) during 2021-22, 2022-23 and in pooled respectively, were recorded with the application of 100 % RDF (f_3). Increase in plant height and number of leaves due to increase in N, P and K fertilizers may be due to adequate supply of nutrients which in turn helps in vigorous vegetative growth of plants and subsequently increase in the plant height and number of leaves through cell elongation, cell division, photosynthesis and turbidity of plant cell (Singh *et al.*, 2021). Similar result has been recorded by Singh *et al.* (2019) in cabbage; Pattar *et al.* (2017) in red cabbage; Gocher *et al.* (2017) in cauliflower.

Data described in (Table 2) shows thatminimum days taken for initiation of head after transplanting (34.77, 36.08 and 35.42) during 2021-22, 2022-23 and in pooled respectively and minimum days taken for edible maturity of head after transplanting (67.73, 69.04 and 68.38) during 2021-22, 2022-23 and in pooled respectively were recorded with the application of 100 % RDF (f_3). It may be due to the earliness in head maturity in the plants treated with chemical fertilizer and organic manures which could be attributed to the fast release of nutrients to the soil together with faster uptake by plants which resulted in better vegetative growth and head maturity (Chaterjee *et al.*, 2005). Furthermore, cabbage is a medium duration crop therefore quick release of major nutrients favored the growth and development of the crop. This finding has a support of Singh *et al.* (2019) in cabbage; Koppad *et al.* (2019) in red cabbage.

Data presented in (Table 3) leaf area at 45 DAT (cm^2) and stem diameter at harvest (cm) were not affected significantly by different treatments.

Effect of different biostimulants. The data enumerated in (Table 1) shows that significantly maximum plant height at harvest (23.15 cm, 23.50 cm and 23.33 cm) during 2021-22, 2022-23 and in pooled respectively and number of leaves per plant at harvest (13.17, 13.56 and 13.37) during 2021-22, 2022-23 and in pooled respectively, were recorded with the application of *jeevamrut* (b_1). Application of *Jeevamrut* showed significant effect on plant height and number of leaves might have helped in higher growth parameters

due the supply of micronutrients, vitamins, essential amino acids and growth promoting substances like Indole Acetic Acid (IAA), Gibberlic Acid (GA3) and beneficial micro-organisms. It is said to enhance microbial activity and ultimately ensuring the availability and uptake of nutrients by thecrop that ultimately increase the plant height (Vedagiri *et al.,* 2022). This finding has a support of Sharma *et al.* (2022) in cauliflower.

Effect of different levels of novel organic liquid nutrient. Data described in (Table 1) shows that significantly maximum plant height at harvest (23.13 cm, 23.54 cm and 23.34 cm) during 2021-22, 2022-23 and in pooled respectively, number of leaves per plant at harvest (12.91, 13.33 and 13.12) during 2020-21, 2021-22 and in pooled respectively were recorded with the application of novel organic liquid nutrient @ 2.0 % (n_3).This significant difference in vegetative characters were observed might be due to availability of nitrogen in novel organic liquid nutrients which stimulated higher vegetative growth. Nitrogen as major constituents of chlorophyll, protein and amino acid, their synthesis can accelerate by the adequate supply of nitrogen from novel organic liquid nutrients. It is also

Effect on yield parameters. The different yield attributing characters *viz.,* average weight of head (g), yield per plot (kg) and yield per hectare (t) were recorded.

Effect of different fertilizer levels. An assessment of data (Table 4) indicated that the application of 100 % RDF (f_3) exhibited significantly maximum average weight of head (529.18 g, 499.62 g and 514.40 g) during 2021-22, 2022-23 and in pooled respectively, significantly higher yield per plot (7.66 kg, 7.60 kg and 7.63 kg) during 2021-22, 2022-23 and in pooled respectively, higher yield per hectare (56.76 t, 56.33 t and 56.54 t) during 2021-22, 2022-23 and in pooled respectively.

The increased head yield due to application of recommended dose of NPK, availability of optimum level of nutrients in the soil and maximum uptake of nutrients by the crop resulting in increased vegetative growth of plant which ultimately influenced increased yield and yield attributes (Pattar *et al.,* 2017). Similar results were reported by Patel *et al.* (2018); Singh *et al.* (2021); Singh *et al.* (2019) and Gupta *et al.* (2018) in cabbage; Koppad *et al.* (2019) in red cabbage and Gocher *et al.* (2017) in cauliflower.

Effect of different biostimulants. Amongst the yield parameters, significantly maximum average weight of head (470.00 g, 456.64 g and 463.32 g) during 2021-22, 2022-23 and in pooled respectively, higher yield per plot (6.87 kg, 6.51 kg and 6.69 kg) during 2021-22, 2022-23 and in pooled respectively, higher yield per hectare (50.87 t, 48.23 t and 49.55 t) during 2021-22, 2022-23 and in pooled respectively were obtained from *Jeevamrut* (b_1). *Jeevamrut* acts as a source of nutrients to the plant, some of these nutrients are in inorganic forms which are readily available to the plant and most of the other nutrients are released gradually by the process of mineralization, which results in the stable source of nutrients to plants and increases head weight responsible for the cell development and formation and accelerating the synthesis of chlorophyll and amino acid which are associated with major photosynthesis and causes higher formation of meristematic tissues that through ultimately increase the height of plant and number of leaves. These results are in conformity with results of Patel (2017) in cabbage.

Interaction effect of different fertilizer levels, biostimulants and novel organic liquid nutrient. Looking to the interaction effect between fertilizer levels and biostimulant, significantly maximum plant height at harvest (26.15 cm, 25.74 cm and 25.94 cm) during 2021-22, 2022-23 and in pooled respectively and number of leaves per plant at harvest (15.27, 16.68 and 15.97) during 2021-22, 2022-23 and in pooled, respectively was found with the treatment combination of 100 % RDF + *jeevamrut* (f_3b_1). Increase in the plant height and number of leaves due to the application of integrated use of NPK fertilizer and organic manures in crop. This might be also due to the synthesis of proteins from nitrogen which formed the carbohydrates in crop plants which in turn favoured plant height (Lodhi *et al.,* 2017). Similar result has been recorded by Sharma *et al.* (2022) in cauliflower and Singh *et al.* (2015).

(Hameedi *et al.,* 2018). Similar results were noticed by Sharma *et al.* (2022) in cauliflower and Vedagiri *et al.* (2022) in chilli.

Effect of different levels of novel organic liquid nutrient. Significantly maximum average weight of head (471.81 g, 455.29 g and 463.55 g) during 2021-22, 2022-23 and in pooled respectively, significantly higher yield per plot (6.79 kg, 6.49 kg and 6.64 kg) during 2021-22, 2022-23 and in pooled respectively, higher yield per hectare (50.30 t, 48.07 t and 49.18 t) during 2021-22, 2022-23 and in pooled respectively were obtained with novel organic liquid nutrient @ 2.0 % (n_3). It might be due to the effect of novel organic liquid fertilizer which contain macro and micronutrients. The nutrients N and K at higher rate exerted a significant positive influence on yield. The other bio-parameters which could have helped in the increase of yield were synthesis of carbohydrates and their translocation to the potential storage organs through better growth and increase the weight of head. All these reasons individually or synergistically resulted in increased vegetative growth reflecting in terms of foliage production (Kalariya *et al.,* 2018). The results are also corroborated by Patel (2017) in cabbage; Chotaliya *et al.* (2020) in okra and Champaneri *et al.* (2021) in Indian bean.

Interaction effect of different fertilizer levels, biostimulants and novel organic liquid nutrient. Looking to the interaction effect between fertilizer levels and biostimulant, significantly maximum average weight of head (543.41 g, 525.64 g and 534.53 g) during 2021-22, 2022-23 and in pooled respectively, significantly higher yield per plot (8.45 kg, 8.28 kg and 8.36 kg) during 2021-22, 2022-23 and in pooled respectively, higher yield per hectare (62.58 t, 61.31 t and 61.95 t) during 2021-22, 2022-23 and in pooled respectively, were found with the treatment combination of 100 % RDF + *Jeevamrut* (f_3b_1).The

increase in head weight might be due to more photosynthesis from a larger area of the leaves and the translocation of photosynthates to the sink which is ultimately the head (Shree *et al.*, 2014). These findings are in close conformity with the findings of Sharma *et al.* (2022) in cauliflower.

Table 1: Effect of fertilizer levels, biostimulants and novel organic liquid nutrient on plant height(cm) at 30 DAT& at harvest and number of leaves per plant at harvest.

Plant height at 30 DAT (cm)				Plant height at harvest (cm)				Number of leaves per plant at harvest			
Treatment	2021-22	2022-23	Pooled	Treatment	2021-22	2022-23	Pooled	Treatment	2021-22	2022-23	Pooled
Fertilizer levels (f)				Fertilizer levels (f)							
f_1	17.49	16.83	17.16	f_1	20.75	21.11	20.93	f_1	10.59	10.63	10.61
f_2	18.92	18.24	18.58	f_2	22.23	22.83	22.53	f_2	12.31	12.61	12.46
f_3	20.83	20.92	20.88	f_3	24.13	24.60	24.37	f_3	14.56	14.81	14.68
S.Em. ±	0.26	0.26	0.26	S.Em. ±	0.31	0.33	0.31	S.Em. ±	0.20	0.22	0.20
C.D. at 5%	0.75	0.75	0.53	C.D. at 5%	0.88	0.95	0.65	C.D. at 5%	0.56	0.61	0.42
Biostimulant (b)				Biostimulant (b)				Biostimulant (b)			
b_1	19.36	19.03	19.19	b_1	23.15	23.50	23.33	b_1	13.17	13.56	13.37
b_2	18.76	18.33	18.56	b_2	21.82	22.21	22.06	b_2	11.88	11.95	11.84
b_3	19.12	18.63	18.88	b_3	22.13	22.75	22.44	b_3	12.41	12.68	12.55
S.Em. ±	0.26	0.26	0.19	S.Em. ±	0.31	0.33	0.23	S.Em. ±	0.20	0.22	0.15
C.D. at 5%	NS	NS	NS	C.D. at 5%	0.88	0.95	0.65	C.D. at 5%	0.56	0.61	0.42
Novel organic liquid nutrient (n)				Novel organic liquid nutrient (n)				Novel organic liquid nutrient (n)			
n_1	18.82	18.38	18.60	n_1	21.68	22.35	22.02	n_1	12.14	12.10	12.12
n_2	19.00	18.60	18.80	n_2	22.29	22.66	22.47	n_2	12.41	12.62	12.52
n_3	19.42	19.02	19.22	n_3	23.13	23.54	23.34	n_3	12.91	13.33	13.12
S.Em. ±	0.26	0.26	0.19	S.Em. ±	0.31	0.33	0.23	S.Em. ±	0.20	0.22	0.15
C.D. at 5%	NS	NS	NS	C.D. at 5%	0.88	0.95	0.65	C.D. at 5%	0.56	0.61	0.42
CV%	7.21	7.36	7.41	CV%	7.18	7.60	7.50	CV%	8.19	8.84	8.79

Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%
f × b	0.46	NS	0.46	NS	0.33	NS
f × n	0.46	NS	0.46	NS	0.33	NS
b × n	0.46	NS	0.46	NS	0.33	NS
f × b × n	0.79	NS	0.79	NS	0.57	NS

Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%
f × b	0.54	1.52	0.58	1.64	0.40	1.12
f × n	0.54	NS	0.58	NS	0.40	NS
b × n	0.54	NS	0.58	NS	0.40	NS
f × b × n	0.93	NS	1.00	NS	0.69	NS

Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%
f × b	0.34	0.97	0.37	1.06	0.26	0.73
f × n	0.34	NS	0.37	NS	0.26	NS
b × n	0.34	NS	0.37	NS	0.26	NS
f × b × n	0.59	NS	0.65	NS	0.45	NS

Table 2: Effect of fertilizer levels, biostimulants and novel organic liquid nutrient on days taken for initiation of head after transplanting and days taken for edible maturity of head after transplanting.

Days taken for initiation of head after transplanting				Days taken for edible maturity of head after transplanting			
Treatment	2021-22	2022-23	Pooled	Treatment	2021-22	2022-23	Pooled
Fertilizer levels (f)				Fertilizer levels (f)			
f_1	39.54	40.12	39.83	f_1	71.81	73.90	72.86
f_2	36.97	38.29	37.63	f_2	69.21	71.96	70.58
f_3	34.77	36.08	35.42	f_3	67.73	69.04	68.38
S.Em. ±	0.66	0.63	0.66	S.Em. ±	1.16	1.37	1.16
C.D. at 5%	1.87	1.80	1.31	C.D. at 5%	3.28	3.88	2.52
Biostimulant (b)				Biostimulant (b)			
b_1	36.27	37.39	36.83	b_1	68.53	70.27	69.40
b_2	37.79	38.75	38.31	b_2	70.64	72.78	71.80
b_3	37.22	38.27	37.74	b_3	69.57	71.68	70.62
S.Em. ±	0.66	0.63	0.47	S.Em. ±	1.16	1.37	0.90
C.D. at 5%	NS	NS	NS	C.D. at 5%	NS	NS	NS
Novel organic liquid nutrient (n)				Novel organic liquid nutrient (n)			
n_1	37.62	38.68	38.15	n_1	70.37	72.71	71.54
n_2	37.25	38.24	37.75	n_2	69.67	71.68	70.67
n_3	36.41	37.57	36.99	n_3	68.71	70.52	69.62
S.Em. ±	0.66	0.63	0.47	S.Em. ±	1.16	1.37	0.90
C.D. at 5%	NS	NS	NS	C.D. at 5%	NS	NS	NS
CV%	9.21	8.62	9.13	CV%	8.63	9.92	9.35

Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%
f × b	1.14	NS	1.10	NS	0.81	NS
f × n	1.14	NS	1.10	NS	0.81	NS
b × n	1.14	NS	1.10	NS	0.81	NS
f × b × n	1.97	NS	1.90	NS	1.40	NS

Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%
f × b	2.00	NS	2.37	NS	1.56	NS
f × n	2.00	NS	2.37	NS	1.56	NS
b × n	2.00	NS	2.37	NS	1.56	NS
f × b × n	3.47	NS	4.10	NS	2.69	NS

Table 3: Effect of fertilizer levels, biostimulants and novel organic liquid nutrient on leaf area at 45 DAT(cm^2) and stem diameter at harvest (cm).

Leaf area at 45 DAT (cm^2)							Stem diameter at harvest (cm)						
Treatment	2021-22		2022-23		Pooled		Treatment	2021-22		2022-23		Pooled	
Fertilizer levels (f)							Fertilizer levels (f)						
f_1	1244.79		1206.04		1225.42		f_1	1.49		1.48		1.48	
f_2	1303.48		1270.18		1286.83		f_2	1.52		1.50		1.51	
f_3	1311.15		1282.49		1296.82		f_3	1.56		1.56		1.56	
S.Em. ±	31.49		32.11		31.49		S.Em. ±	0.03		0.03		0.03	
C.D. at 5%	NS		NS		NS		C.D. at 5%	NS		NS		NS	
Biostimulant (b)							Biostimulant (b)						
b_1	1321.44		1294.77		1308.11		b_1	1.55		1.57		1.56	
b_2	1245.55		1194.38		1229.32		b_2	1.49		1.48		1.49	
b_3	1292.43		1250.85		1271.64		b_3	1.52		1.48		1.50	
S.Em. ±	31.49		32.11		22.50		S.Em. ±	0.03		0.03		0.02	
C.D. at 5%	NS		NS		NS		C.D. at 5%	NS		NS		NS	
Novel organic liquid nutrient (n)							Novel organic liquid nutrient (n)						
n_1	1252.11		1225.47		1238.79		n_1	1.47		1.47		1.47	
n_2	1300.26		1237.18		1268.72		n_2	1.54		1.52		1.53	
n_3	1307.06		1296.07		1301.56		n_3	1.55		1.54		1.55	
S.Em. ±	31.49		32.11		22.50		S.Em. ±	0.03		0.03		0.02	
C.D. at 5%	NS		NS		NS		C.D. at 5%	NS		NS		NS	
CV%	12.72		13.32		13.02		CV%	10.02		11.00		10.81	
Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%
f × b	54.55	NS	55.61	NS	38.98	NS	f × b	0.05	NS	0.06	NS	0.04	NS
f × n	54.55	NS	55.61	NS	38.98	NS	f × n	0.05	NS	0.06	NS	0.04	NS
b × n	54.55	NS	55.61	NS	38.98	NS	b × n	0.05	NS	0.06	NS	0.04	NS
f × b × n	94.48	NS	96.33	NS	67.51	NS	f × b × n	0.09	NS	0.10	NS	0.07	NS

Table 4: Effect of fertilizer levels, biostimulants and novel organic liquid nutrient on average weight of head (g), yield per plot (kg) and yield per hectare (t).

Average weight of head (g)							Yield per plot (kg)							Yield per hectare (t)					
Treatment	2021-22		2022-23		Pooled		Treatment	2021-22		2022-23		Pooled		Treatment	2021-22		2022-23		Pooled
Fertilizer levels (f)							Fertilizer levels (f)												
f_1	371.4		380.5		376.0		f_1	5.387		5.073		5.230		f_1	39.90		37.58		38.74
f_2	459.4		453.9		456.6		f_2	6.487		6.185		6.336		f_2	48.05		45.81		46.93
f_3	529.1		499.6		514.4		f_3	7.662		7.604		7.633		f_3	56.76		56.33		56.54
S.Em. ±	8.39		8.66		8.39		S.Em. ±	0.14		0.13		0.14		S.Em. ±	1.07		0.96		1.07
C.D. at 5%	23.82		24.56		17.15		C.D. at 5%	0.41		0.37		0.28		C.D. at 5%	3.03		2.74		2.04
Biostimulant (b)							Biostimulant (b)							Biostimulant (b)					
b_1	470.0		456.6		463.3		b_1	6.867		6.510		6.689		b_1	50.87		48.23		49.55
b_2	440.8		426.1		433.6		b_2	6.093		5.977		6.033		b_2	45.13		44.27		44.69
b_3	449.2		451.0		450.1		b_3	6.576		6.378		6.477		b_3	48.71		47.24		47.98
S.Em. ±	8.39		8.66		6.11		S.Em. ±	0.14		0.13		0.10		S.Em. ±	1.07		0.96		0.73
C.D. at 5%	23.82		24.56		17.15		C.D. at 5%	0.41		0.37		0.28		C.D. at 5%	3.03		2.74		2.04
Novel organic liquid nutrient (n)							Novel organic liquid nutrient (n)							Novel organic liquid nutrient (n)					
n_1	437.8		426.8		432.3		n_1	6.265		6.026		6.146		n_1	46.41		44.64		45.52
n_2	450.4		451.9		451.2		n_2	6.480		6.347		6.414		n_2	48.00		47.02		47.51
n_3	471.8		455.2		463.5		n_3	6.791		6.489		6.640		n_3	50.30		48.07		49.18
S.Em. ±	8.39		8.66		6.11		S.Em. ±	0.14		0.13		0.10		S.Em. ±	1.07		0.96		0.73
C.D. at 5%	23.82		24.56		17.15		C.D. at 5%	0.41		0.37		0.28		C.D. at 5%	3.03		2.74		2.04
CV%	9.62		10.11		10.01		CV%	11.51		10.76		11.28		CV%	11.51		10.76		11.28
Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	Interaction effect	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%	S.Em. ±	C.D. at 5%
f × b	14.54	41.26	14.99	42.54	10.59	29.70	f × b	0.25	0.71	0.23	0.64	0.17	0.48	f × b	1.85	5.25	1.67	4.74	1.26	3.53
f × n	14.54	NS	14.99	NS	10.59	NS	f × n	0.25	NS	0.23	NS	0.17	NS	f × n	1.85	NS	1.67	NS	1.26	NS
b × n	14.54	NS	14.99	NS	10.59	NS	b × n	0.25	NS	0.23	NS	0.17	NS	b × n	1.85	NS	1.67	NS	1.26	NS
f × b × n	25.18	NS	25.97	NS	18.34	NS	f × b × n	0.43	NS	0.39	NS	0.29	NS	f × b × n	3.20	NS	2.89	NS	2.18	NS

CONCLUSIONS

On the basis of experimental evidence, higher growth and yield from cabbage cultivation can be obtained with the combined application of 100% recommended dose of fertilizer with the soil application of *jeevamrut* @ 500 l/ha drenching at 15, 30, 45 and 60 DAT and foliar spray @ 2.0 % of novel organic liquid nutrient at 20 and 40 DAT.

FUTURE SCOPE

There is a vast scope to do research with such type of issues on biotic and abiotic stresses vegetables to fulfill the growing demands of vegetables. Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner.

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