THE ASIAN JOURNAL OF HORTICULTURE
Volume **8** | Issue 2 | December, 2013 | 537-540

Research Paper

Article history **:**
Received : 12.06.2013
Revised : 18.09.2013
Accepted : 01.10.2013

Response of different levels of NPK and microbial inoculants on quality of hybrid cabbage (*Brassica oleracea* var. capitata L.)

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ABSTRACT : The experiments were conducted at Bihar Agricultural College, Sabour, Bhagalpur (Bihar) during the two consecutive *Rabi* seasons of 2006-07 and 07-08 to assess the efficacy of different levels of chemical fertilizes and microbial inoculants on quality attributes of hybrid cabbage. Five levels of chemical fertilizers (F_1 – N_{80} P_{40} K_{40}, F_2 – N_{120} P_{60} K_{60}, F_3 – N_{160} P_{80} K_{80}, F_4 – N_{200} P_{100} K_{100} and F_5 – N_{240} P_{120} K_{120}) and five treatments of microbial inoculants (M_1-0, M_2- *Azotobacter*, M_3-*Azospirillum*, M_4 – VAM and M_5 – PSB) were taken for investigation. Among the various fertility levels of chemical fertilizers, N_{240} P_{120} K_{120} gave the maximum protein, phosphorus and calcium content in head of cabbage while ascorbic acid was higher at fertility level of N_{80} P_{40} $K_{40.}$ The plant developed under inoculation of biofertilizer *Azospirillum* produced the highest protein content in head where as microbial inoculants PSB or VAM gave maximum phosphorus and calcium in head. However, the interaction effects of microbial inoculants and levels of chemical fertilizers on quality were failed to touch the level of significance.

KEY WORDS : NPK, Microbial inoculants, Hybrid cabbage

HOW TO CITE THIS ARTICLE : Singh,V.K., Singh, K.P. and Ranjan, Ashish (2013). Response of different levels of NPK and microbial inoculants on quality of hybrid cabbage (*Brassica oleracea* var. capitata L.). *Asian J. Hort.*, **8**(2) : 537-540.

Cabbage (*Brassica* olearacea var. capitata L.) is one of the most important cole crops grown in India. Hybrids of Cabbage are attracting the growers due to their higher yield potential, better quality and storage ability. A crop yielding more is bound to extract more nutrients from the soil, which shall have to be replenished by different sources of nutritive feed to minimize the dosages of chemical fertilizers. The globalization of world trade has created strange market competition for Indian agriculture, where apart from increased production; the quality improvement of produce is a major requirement. In view of these concerns, the alternate agriculture system has been adopted globally. The essential concept and philosophy of such practices are to feed the soil rather than the crops to maintain its health and save environment, *i.e*, giving back to the nature what has been taken from it (Funtelana, 1990). Today, it is not only a question of providing enough vegetables for balanced diet, but also to produce quality vegetables that are acceptable and competitive in the international market. Also, inview of the escalating cost of chemical fertilizers, and their hazardous effect on soil, it is imperative to explore the possibility of supplementing chemical fertilizers with ecofriendly low cost inputs of microbial inoculants. The microbial inoculants improve nutrient availability resulting in enhanced growth, yield and quality of vegetable crops, besides reducing the quantum of nutrients. Keeping in view their significance, present investigation was undertaken to assess the effect of biofertilizers alone as well as in conjunction with chemical fertilizers on the quality of hybrid cabbage.

RESEARCH METHODS

The experiment was conducted in the Department of Horticulture (Vegetables and Floriculture) at Bihar Agricultural College, Sabour during the *Rabi* season 2006-07 and 2007-08. Treatments comprised of five levels of chemical fertilizers *viz.*, F_1 – N_{80} P_{40} K_{40}, F_2 – N_{120} P_{60} K_{60}, F_3 – N_{160} P_{80} K_{80}, F_4 – N_{200} P_{100} K_{100} and F_5 – N_{240} P_{120} K_{120} and five biofertilizers *viz.*, M_1 – O, M_2 – *Azotobacter*, M_3 –

Azospirillum, M_4 – VAM and M_5 – PSB and their combinations. Treatments were applied in three replications having Factorial Randomized Block Design experimental design. Microbial inoculants were applied as seed and seedling treatment as well as soil application @ 5kg/ha. For estimation of moisture, the head of plant was weighed and chopped into five pieces and dried in an oven at 80^0 C till constant weight was obtained and moisture percentage was calculated. For estimation of nutrients, the dried plant material was grounded in grinder. From grinded material only 0.5g was taken for digestion in a flask and nitrogen was estimated by modified Kjeldahl's method (A.O.A.C., 1980 and Jackson, 1963), phosphors by vanadomolybdo phosphoric yellow colour method (Koening and Johnson, 1942) and potash by using flame photometer (Jackson, 1967). For estimation of ascorbic acid 2, 6 – dichlorophenal indophenols method (A.O.A.C., 1975) was adopted and calcium was determined by versenate titration method (Cheng and Bray, 1951).

RESEARCH FINDINGS AND DISCUSSION

The scrutiny of data in Table 1 revealed that biofertilizers and chemical fertilizers as well as their interaction effects failed to bring about significant variations in moisture percentage in head.

The results clearly demonstrated that the ascorbic acid content in head decreased significantly with successive increment in the dosages of fertilizers (Table 2). The plants getting the lowest dose of fertilizers *i.e.*, $F_1(N_{80}\ P_{40}\ K_{40})$ increased the highest ascorbic acid content (88.48mg/100g) in head which showed parity with fertility level of F_2 ($N_{100}\ P_{60}\ K_{60}$). The decrease in ascorbic acid content in head might be due to reduced physiological process like synthesis of carbohydrates. These results are in accordance with the findings of Wange *et al*. (2003), Singh *et al.* (2004), Guo *et al.* (2004) and Sable and Bhamare (2007). Application of biofertilizers significantly induced acceleration in ascorbic acid production in head. The biofertilizer M_2 (VAM) produced the highest ascorbic acid content (86.84mg/100g) in head which was at par with M_4 (PSB). The increase in ascorbic acid content might be due to growth promoting substances secreted by VAM and PSB, which could have accelerated the physiological processes like synthesis of carbohydrates, resulting in increase in ascorbic acid content which is a sugar acid. These findings are in close agreement with the report of Chatto *et al.* (1997) and Sable and Bhamare (2007). It is clear from the Table 3 that there was an increasing trend in protein content in head with every ascending level of NPK and the highest value (15.31%) was recorded at the fertility level of F_5 ($N_{240}\ P_{120}\ K_{120}$) which showed statstcal parity with F_4 ($N_{200}\ P_{100}K_{100}$). The native soil nitrogen obviously was not enough to supply nitrogen to the crop in quantities sufficient for optimum growth. The application of NPK nutrients made up this deficiency and resulted in the improvement of nitrogen status of the plant. These results are in conformity with the findings of Sharma and Chandra (2004), Aquino etal

Table 1 : Effect of biofertilizers and chemical fertilizers on moisture content (%) in head of cabbage (pooled data of 2006-07 and 2007-08)

Bio-fertilizers	Levels of chemical fertilizers (kg/ha)					Mean
	F_1 $N_{80}P_{40}K_{40}$	F_2 $N_{120}P_{60}K_{60}$	F_3 $N_{160}P_{80}K_{80}$	F_4 $N_{200}P_{100}K_{100}$	F_5 $N_{240}P_{120}K_{120}$	
M_1 – O	91.23	91.70	92.13	92.28	92.40	91.95
M_2-*Azotobacter*	91.41	91.94	92.22	92.35	92.42	92.07
M_3- *Azospirillum*	91.50	92.04	92.26	92.41	92.46	92.13
M_4 – VAM	91.33	91.86	92.19	92.30	92.42	92.02
M_5 – PSB	91.37	91.90	92.19	92.31	92.43	92.04
Mean	91.37	91.89	92.20	92.33	92.43	

C.D. (P=0.05) Biofertilizer (M) – NS, Chemical fertilizer (F) – NS, MXF – NS

Table 2 : Effect of biofertilizers and chemical fertilizers on ascorbic acid (mg/100g of juice) of cabbage head (pooled data of 2006-07 and 2007-08)

Bio-fertilizers	Levels of chemical fertilizers (kg/ha)					Mean
	F_1 $N_{80}P_{40}K_{40}$	F_2 $N_{120}P_{60}K_{60}$	F_3 $N_{160}P_{80}K_{80}$	F_4 $N_{200}P_{100}K_{100}$	F_5 $N_{240}P_{120}K_{120}$	
M_1 – O	85.66	83.32	81.47	78.04	75.15	80.73
M_2-*Azotobacter*	88.01	86.18	84.49	81.16	78.35	83.64
M_3- *Azospirillum*	88.95	86.93	85.34	82.14	79.45	84.56
M_4 – VAM	90.53	89.20	87.69	84.67	82.13	86.84
M_5 – PSB	89.27	87.35	85.67	82.66	79.94	84.98
Mean	88.48	86.59	84.93	81.73	79.00	

C.D. (P=0.05 Biofertilizer (M) – 1.99, Chemical fertilizer (F) – 1.99, MXF - NS

(2005) and Sable and Bhamare (2007). The maximum protein content in head (15.17%) was significantly associated with application of microbial insculant M_3 (*Azospirillum*), however, it was at par with M_2 (*Azotobacter*). This may be related to optimum supply of N by virtue of microbial inoculants and availability of other nutrients at all stages of crop growth might have favoured a luxuriant growth and accumulation of more nutrients in the vegetative organs and there by increasing the quality of cabbage head with regard to protein. Similar observations were recorded by Sable and Bhamare (2007).

The phosphorus content in head increased with every ascending level of NPK applied and the highest value (0.823%) was recorded at the highest fertility level of F_5 (N_{240} P_{120} K_{120}) (Table 4). The application of higher dosages of NPK, which in turn, might have led to better root development, better transportation of water, uptake and deposition of nutrients. These results get support from the work of Eid *et al.* (1998), Leis and Lepik (2001) and Sharma and Chandra (2004). The phosphorus content in head was significantly influenced by biofertilizers. The maximum phosphorus (0.815%) content was obtained with application of PSB which was at par with VAM. The inoculated phosphobacteria might have solubilized the aluminium and iron phosphates as well as rock phosphates present in the soil making the fixed phosphorus available to the plant, ultimately leading to increased P content in different parts of plant as well as in head. Similar results were reported by Chattoo *et al.* (1997).

It is obvious from Table-5 that calcium content in head increased with successive increment in the level of NPK and the maximum content (0.699%) was attained at the fertility level of F_5 (N_{240} P_{120} K_{120}), which showed a parity with F_4 (N_{200} P_{100} K_{100}). Higher levels of NPK might have led to better root development and better uptake of nutrients. Similar trends were also found by Sharma and Chandra

Table 3 : Effect of biofertilizers and chemical fertilizers on protein content in head (%) in head of cabbage (pooled data of 2006-07 and 2007-08)

Bio-fertilizers	Levels of chemical fertilizers (kg/ha)					
	F_1 $N_{80}P_{40}K_{40}$	F_2 $N_{120}P_{60}K_{60}$	F_3 $N_{160}P_{80}K_{80}$	F_4 $N_{200}P_{100}K_{100}$	F_5 $N_{240}P_{120}K_{120}$	Mean
M_1 – O	13.50	14.17	14.55	14.78	14.95	14.39
M_2-*Azotobacter*	14.11	14.82	15.15	15.29	15.40	14.95
M_3- *Azospirillum*	14.38	15.08	15.34	15.52	15.56	15.17
M_4 – VAM	13.91	14.64	14.93	15.15	15.25	14.77
M_5 – PSB	14.04	14.76	15.03	15.24	15.38	14.89
Mean	13.99	14.69	15.00	15.20	15.31	

C.D. (P=0.05) Biofertilizer (M) – 0.27, Chemical fertilizer (F) – 0.27, MXF – NS

Table 4 : Effect of biofertilizers and chemical fertilizers on P-content (%) in head of cabbage head (pooled data of 2006-07 and 2007-08)

Bio-fertilizers	Levels of chemical fertilizers (kg/ha)					
	F_1 $N_{80}P_{40}K_{40}$	F_2 $N_{120}P_{60}K_{60}$	F_3 $N_{160}P_{80}K_{80}$	F_4 $N_{200}P_{100}K_{100}$	F_5 $N_{240}P_{120}K_{120}$	Mean
M_1 – O	0.719	0.762	0.779	0.793	0.803	0.771
M_2-*Azotobacter*	0.742	0.785	0.801	0.814	0.820	0.792
M_3- *Azospirillum*	0.750	0.791	0.807	0.819	0.827	0.799
M_4 – VAM	0.754	0.795	0.811	0.822	0.827	0.802
M_5 – PSB	0.770	0.810	0.824	0.835	0.838	0.815
Mean	0.747	0.788	0.804	0.816	0.823	

C.D. (P=0.05) Biofertilizer (M) – 0.016, Chemical fertilizer (F) – 0.016, MXF - NS

Table 5 : Effect of biofertilizers and chemical fertilizers on Ca content (%) in head of cabbage (pooled data of 2006-07 and 2007-08)

Bio-fertilizers	Levels of chemical fertilizers (kg/ha)					
	F_1 $N_{80}P_{40}K_{40}$	F_2 $N_{120}P_{60}K_{60}$	F_3 $N_{160}P_{80}K_{80}$	F_4 $N_{200}P_{100}K_{100}$	F_5 $N_{240}P_{120}K_{120}$	Mean
M_1 – O	0.614	0.649	0.664	0.675	0.683	0.657
M_2-*Azotobacter*	0.633	0.668	0.682	0.692	0.692	0.673
M_3- *Azospirillum*	0.640	0.674	0.687	0.696	0.703	0.680
M_4 – VAM	0.656	0.689	0.701	0.710	0.712	0.693
M_5 – PSB	0.643	0.677	0.689	0.699	0.704	0.682
Mean	0.637	0.671	0.684	0.694	0.699	

C.D. (P=0.05) Biofertilizer (M) – 0.014, Chemical fertilizer (F) – 0.014, MXF - NS

(2004). The application of biofertilizers significantly induced acceleration in calcium content in head and the maximum (0.693) was found with application of VAM which was at par with PSB and *Azospirillum*. The phosphobacteria might have solubilised the tricalcium present in the soil making the fixed calcium available to the plant resulting in increased calcium content in the head. These results are in agreement with the findings of Chattoo *et al.* (1997).

REFERENCES

A.O.A.C. (1975). *Official methods of analysis*, Associntion of official analytical chemist 12th Ed. Washingtion, D.C., U.S.A.

A.O.A.C. (1980). *Official methods of analysis*, Association of official analytical chemist 13th Ed. Washingten, D.C., U.S.A.

Aquino, L.A. de., Puiatti, M., Pereira, P.R.G., Pereira, F.H.F., Laderia, I.R. and Castro, M.R.S. (2005). Effect of spacing and does of nitrogen on the qualitative characteristics of the yield of cabbage. *Hort. Brasileira*, **23** (1) : 100-104.

Cheng, K.L and Bray, R.H. (1951). Determination of calcium and magnesium in soil and plant material. *Soil Sci.*, **72** (6) : 449-458

Chattoo, M.A., Gandroo, M.Y. and Zargar, M.Y. (1997). Effect of *Azospirillum* and *Azotobacter* and growth, yield and quality of knol-khol (*Brassica oleracea* var. gongylodes L.). *Veg. Sci.*, **24** (1) : 16-19

Eid, S.M., Badr, L.A.A., Amer, A.E.A. and N.M.M. El-shimi (1998). Cabbage plant growth, yield and quality as affected by fertilizers source. *Annal. Agril. Sci, Moshtohor*, **36** (3):1721-1736.

Guo, Xisheng, Hongbin Zhu, Wenjun wang, Shuya ye, Ji Wu and Lishu Xu (2004). Effect of different rates of nitrogen and potassium on the yield and quality of cabbage plant. *Nutri. & Fert. Sci.*, **10** (2): 161-166

Jackson, M.L. (1963). *Nitrogen determination for soil and plant Tissues*. Prentice Hall of India Pvt. Ltd., New Delhi, India.

Jackson, M.L. (1967). *Soil chemical analysis*, Prentice Hall of India Pvt. Ltd, New Delhi, India.

Koening, R.A. and Johnson, C.R. (1942). Colorimetric determination of P in biological materials. *Indian Chem. Anal.*, **14** (2) : 155-156.

Leis, L. and Lepik, A. (2001). Macro and micronutrients in white cabbage and carrot. *Sodininkyste ir Darzininkyste*, **20**(3/2) : 300-307.

Sable, P.B. and Bhamare, V.K. (2007). Effect of biofertilizers (*Azitobacter* and *Azospirillum)* alone or in combination with reduced levels of nitrogen on quality of cauliflower CV. SNOWBALL 16. *Asian J. Hort.*, **2** (2) : 215-217.

Sharma, Amreesh and Chandra, Atul (2004). Effect of plant density and nitrogen levels on physico-chemical parametars of cauliflower. *Haryana J. Hort.*, **33** (1 & 2) : 148-149.

Singh, Satish Kumar, Singh, T., Singh, B.N. and Verma, R.B. (2004). Response of fertility levels and plant density on growth, yield and quality of hybrid Cabbage. *Veg. Sci.*, **31** (1) : 69-72.

Wang, Zheng Yin, Huipe Li, Baozhen Li, Xiujian Ye, Pengshou Sun, Henglin Dai and Tianchang Xiang (2003). Influence of nitrogen rates, soil fertility and harvest time on nitrate in chinese cabbege. *Scientia Agricultura Sinica*, **36**(9) : 1057-1064.