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Influence of nitrogen and biofertilizer on growth and yield of cabbage

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Nutrient management involving use of chemical fertilizers combined with organic manures and biofertilizers in balanced proportion may be helpful to increase the productivity of vegetable crops. This strategy of Integrated Plant Nutrient System (IPNS) is very important in recent days considering the harmful effects of indiscriminate use of chemical fertilizers. Most of the vegetable crops are annual, short duration in nature and heavy feeder of plant nutrients. Among the major plant nutrients, nitrogen is mobile both in soil and within the plant. Inorganic nitrogenous fertilizers are commonly used by most of the farmers because of the quick availability of nitrogen by the plants. Biofertilizers are different types of beneficial microorganisms which have the ability to mobilize nutrient elements from nonusable to usable form. *Azotobacter* is a free living, aerobic nitrogen fixing bacteria and its application save the considerable amount of inorganic nitrogenous fertilizers required by the crops. Beneficial role of *Azotobacter* towards higher vegetable and seed yield of cabbage was reported by Verma *et al.* (1997).In view of the facts discussed earlier, the present investigation was undertaken to study the influence of nitrogen and biofertilizer on growth and yield of cabbage.

The experiment was conducted at Horticulture Research Station, Mondouri of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal between October, 2008 and February, 2009. Cabbage variety Golden Acre was used for the study. Individual plot size was 4.2 m x 3.6 m where four weeks old cabbage seedlings were transplanted at the spacing of 60 cm x 60 cm. The experiment was laid out in a randomized block design with three replications. The treatments comprised of four levels of nitrogen viz. 0, 60, 80 and 100 kg/ha along with two levels of biofertilizer i.e. with or without *Azotobacter*. In all of the treatments, half of the nitrogen was applied as basal and remaining quantities were top dressed in two splits viz. third and six weeks after transplanting. Before transplanting cabbage seedlings were inoculated by dipping them in the slurry of *Azotobacter* for 20 minutes. Inoculated seedlings were transplanted into the field immediately. Other cultural practices scheduled for its cultivation were followed in time.

Results indicated that application of both nitrogen and biofertilizer had significant impact on growth and yield attributing characters and yield. In relation to application of nitrogen, all the attributes recorded in the experiment were significantly influenced, except the number of outer leaves. Among the different levels of nitrogen, application of 100 kg $N.ha^{-1}$ proved to be superior followed by 80 kg $N.ha^{-1}$. In all the cases, no nitrogen had no beneficial effect. This might be due to the fact that nitrogen increased the chlorophyll content of the leaves which ensured production of more carbohydrates and these accelerated growth and head yield of cabbage (Sharma, 2002 and Lopandic and Zaric, 1997).

Azotobacter inoculated cabbage plants performed better than non inoculated plants and statistical differences were noted in this respect except number of outer leaves. Plants those were inoculated with biofertilizer recorded head yield of 31.77 $tn.ha^{-1}$ which was 19.66% higher over the non inoculated plants. *Azotobacter* promoted growth and development of cabbage plants by helping in the synthesis of auxin, vitamins, growth substances, antifungal and antibiotics. Perhaps these factors help to increase head yield of cabbage in biofertilizer inoculated treatments. The better results obtained due to *Azotobacter* inoculation are also supported by the findings of Jeevajohti *et al.* (1993) in cabbage where they reported that growth promoting substances secreted by microbial inoculants might have lead to better root development, better transport of water, uptake and deposition of nutrients.

Interactions of different levels of nitrogen and biofertilizer resulted significant influence only on head weight and head yield of cabbage (Table -1). Interactions failed to influence other yield parameters significantly in the present study. The combined application of 100 kg $N.ha^{-1}$and biofertilizer recorded highest head yield of 37 .80 $tn.ha^{-1}$ which was significantly higher than the other combinations. Better performances of the yield parameters might contribute to the higher head yield. Verma *et al.* (1997) also recorded highest vegetable and seed yield

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of cabbage due to application of 60 kg N.ha^{-1} along with *Azotobacter* inoculation.

From the above results, it can be concluded that application of nitrogen @ 100 kg/ha through inorganic sources combined with *Azotobacter* inoculation is the best to obtain highest head yield of cabbage.

Table 1: Influence of nitrogen and biofertilizer on growth and yield of cabbage

Treatment	No. of outer leaves	No. of inner leaves	Head length (cm)	Head diameter (cm)	Stock length (cm)	Head weight (kg)	Head yield (tn.ha^{-1})
Levels of Nitrogen							
N_0 (0 kg/ha)	11.33	22.00	14.06	11.99	7.69	0.72	23.53
N_1 (60kg/ha)	12.00	24.00	15.54	13.84	8.08	0.86	27.63
N_2 (80kg/ha)	12.17	24.83	16.27	13.99	8.14	1.15	29.85
N_3 (100kg/ha)	12.50	29.83	17.407	14.76	8.25	1.29	35.62
SEm(±)	**0.449**	**0.518**	**0.331**	**0.337**	**0.019**	**0.018**	**0.323**
LSD(0.05)	**NS**	**1.573**	**1.004**	**1.024**	**0.061**	**0.056**	**0.979**
Levels of Biofertilizer							
B_0 (without *Azotobacter*)	11.67	23.917	15.21	13.09	7.86	0.95	26.55
B_1(with *Azotobacter*)	12.33	26.417	16.43	14.20	8.21	1.06	31.77
SEm(±)	**0.318**	**0.367**	**0.234**	**0.239**	**0.014**	**0.013**	**0.228**
LSD(0.05)	**NS**	**1.112**	**0.709**	**0.724**	**0.043**	**0.039**	**0.693**
Interactions of nitrogen and biofertilizer							
N_0B_0	10.33	21.67	13.33	11.33	7.49	0.65	19.80
N_0B_1	12.33	22.33	14.79	12.67	7.90	0.79	27.27
N_1B_0	11.67	22.67	15.22	13.27	7.95	0.76	25.57
N_1B_1	12.33	25.33	15.86	14.05	8.23	0.95	27.37
N_2B_0	11.66	23.00	15.86	13.79	7.99	1.10	29.70
N_2B_1	12.67	26.67	16.66	14.20	8.34	1.21	32.33
N_3B_0	13.00	28.33	16.40	13.91	8.05	1.28	33.47
N_3B_1	12.00	31.33	18.37	15.55	8.46	1.30	37.80
SEm(±)	**0.636**	**0.733**	**0.468**	**0.477**	**0.028**	**0.027**	**0.457**
LSD(0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**0.079**	**1.385**

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