SUMMARY AND CONCLUSION

The “Integrated Nutrient management (INM) on broccoli” was undertaken with the help of the field experiment conducted at Regional Research and Technology Transfer Station, Keonjhar, situated under North Central Plateau Zone of Orissa.

The objectives of the experiment were (i) to find out the effects of two forms of organic manures and their combinations on growth and yield, (ii) the suitable dose of NPK fertilizers for higher yield, (iii) the effect of bio-fertilizers on yield and quality of the produce, (iv) the efficacy of different INM schedules for improving the productivity and quality and (v) the profitability (benefit-cost ratio) of different INM schedules.

The experiment was conducted during rabi season of 2008-09 and 2009-10. The land type was medium with irrigation facility from a pond situated at higher elevation. The soil of the experimental site was loamy in texture, strongly acidic in reaction and well supplied with organic, inorganic and bio-fertilizers.

The broccoli var. Puspa received two forms of organic manures i.e., FYM and vermicompost at 10 t/ha and 5 t/ha and their combinations at 50% of each, two doses of inorganic fertilizers i.e., 75% and 100% of recommended dose of N: P: K (150:45:80 kg/ha based on soil test) with and without bio-fertilizers (Azotobacter, Azospirillum and PSB in 1:1:1), bio-fertilizers alone as well as the absolute control. The bio-fertilizers were inoculated with well decomposed FYM in 1:25 ratio, incubated for 7 days at 30% moisture, and then applied @ 6 kg mixed inoculums/ha. All total there were 24 treatments tried in factorial RBD with three replications.
The crops were grown successfully with proper irrigation and plant protection measures. Both plant (economic and uneconomic parts) and soil samples were analysed for different nutrient concentration and their uptake. Then the recoveries were calculated. Biometrical observations and the yield was recorded in order to judge the influence of different treatments on the crop during both the years.

Application of different levels of NPK through inorganic source in combination with bio-fertilizers and organic manures increased the curd weight, thereby increasing the yield per hectare. Maximum yield during both years of experiment (121.14 and 125.63 q/ha) and the average (123.38 q/ha) was recorded using 100% NPK of recommended dose of inorganic fertilizers along with bio-fertilizers and 50% of each FYM and vermicompost as organic manures. The highest yield of this treatment was due to the sum total effects of yield contributing characters like stem girth, leaves per plant, leaf area, curd diameter, unit curd weight etc. Other biometric characters viz., plant height, plant biomass yield, curd dry matter and total dry matter of plant were topped the list under this treatment because of overall increase in the growth of the plant.

The curd yield was low when organic manures alone or biofertilizers alone were applied to the crop but the yield was boosted when inorganic fertilizers were applied with biofertilizers or inorganic fertilizers alone or integrated with organic manures or in combinations. The curd yield as well as unit curd weight have been significantly increased over control in the treatments having 100% NPK with bioinoculants or 100% NPK alone. However, much differences were not observed by applying 100% NPK or 75% NPK alone.

The uptake of nutrients like N, P, K, Ca, Mg and S were high under 100% NPK + BI along with 50% of each of FYM and vermicompost which was reflected in increasing the vegetative growth, better foliage production and other yield
attributing characters including the curd yield. The lowest uptake was with zero levels of inorganic fertilizers, bio-fertilizers and organic manures i.e., control.

The apparent recovery of major nutrients like N, P, and K was influenced by both organic manures and inorganic fertilizers alone as well as in combination with bio-fertilizers. The N, P, and K recovery followed almost a similar trend i.e., the highest recovery was influenced by vermicompost alone. The maximum recovery of N, P, and K was observed by the application of vermicompost alone and 75% chemical fertilizers in presence of bioinoculants. The recovery was increased because the chemical fertilizers mixed with bioinoculants in presence of vermicompost could maintain the higher concentration of different essential nutrients till the harvest due to mineralization and fixation process. Integrating the bio-fertilizers with 75% NPK of recommended dose of inorganic fertilizers along with vermicompost as organic manure resulted the maximum recovery of N, P, and K by 63.5%, 50.3% and 79.1%, respectively.

Ascorbic acid, reducing sugar as well as total sugar content was marked to be the highest by applying both FYM and vermicompost as well as bioinoculants which signifies that the quality parameters of the curd can be improved by applying different organics with or without bioinoculants.

The economics of broccoli crop was calculated from the pooled data of the experiments conducted during 2008-09 and 2009-10. The maximum cost of Rs.43,508/- was calculated by applying 100% recommended dose of chemical fertilizers with bio-fertilizers and vermicompost were applied. The minimum cost of inputs was calculated in control. So far the net return is concerned, maximum return of Rs. 1,68,047/ha was obtained by applying 100% NPK + BI with 50% of each FYM and vermicompost. Similar trend was also observed in benefit-cost ratio, where maximum amount of return was obtained for rupee of investment in this treatment. The highest benefit-cost ratio was 5.08 which was the highest than other treatment combinations including control.
CONCLUSION

The curd yield of broccoli can be boosted to the maximum by combined application of 100% NPK + BI along with 50% of each FYM and vermicompost as an organic source. The chemical fertilizers can boost the yield but the soil health can be maintained due to the application of biofertilizers and organic manures. It is evident from the experiments that the broccoli crop can readily absorb and utilize the nutrients and express the highest value in all characters including the yield.

The investigation carried out for two years on integrated nutrient management on broccoli in North Central Platue Zone of Orissa revealed that by applying 100% NPK + BI with 50% of each of FYM and vermicompost as organic source gave the highest yield (139.49 q/ha) as well as benefit-cost ratio (5.08) maintaining the soil health to certain extent. The broccoli crop can increase the margin of profit to an extent of Rs.168047 by spending a sum of Rs.41188.
FUTURE SCOPE OF RESEARCH

1. More varieties of broccoli should be tested in all the agro-climatic zones of Orissa so as to select for stable varieties for higher yield.
2. The different combinations of integrated nutrient management are also to be tested to find out the best combination of organic, inorganic and bio-fertilizers.
3. More attention should be given to grow the crop with different organic manures and bio-fertilizers so as to produce better quality curds with higher market value.
4. Varieties are also to be evaluated for better yield as well as better keeping quality.