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To study the effects of organic, inorganic and Biofertlizer on yield attributes of cabbage (*Brassica oleracea var. capitata*)

Rishikesh Mishra, RK Bisen, HP Agrawal and SK Verma

Abstract
The experiment was conducted during Rabi season 2020-21 at Horticulture Research Farm, Barrister Thakur Chhedilal College of Agriculture & Research Station, Bilaspur, Chhattisgarh. The treatments consisted of ten combinations of organic, inorganic and biofertilizers with recommended fertilizer doses *viz*., 100% RDF (T1), 75% RDF + 25% Nitrogen through FYM (T2), 75% RDF + 25% Nitrogen through Vermicompost (T3), 50% RDF + 50% Nitrogen through FYM (T4), 50% RDF + 50% Nitrogen through Vermicompost (T5), 100% RDF + 25% Nitrogen through Vermicompost (T6), 100% RDF + 25% Nitrogen through FYM (T7), 75% RDF + 25% Nitrogen through Vermicompost + *Azotobacter* @ 2 kg / ha + PSB @ 2 kg / ha (T8), 75% RDF + 25% Nitrogen through FYM + *Azotobacter* @ 2 kg / ha + PSB @ 2 kg / ha (T9) and control plot (T10). Significantly maximum head formation% 96.5% was found in (T8), head weight 898 g in T8 at harvest and highest head yield 432.0 q/ha in T8 at harvest.

Keywords: Cabbage, integrated nutrient management, FYM, vermicompost, *Azotobacter*, PSB

Introduction
Cabbage (*Brassica oleracea var. capitata*) is a prevalent winter vegetable. It has high value of carbohydrate protein and fiber as well as sinigrin compound which show anticancer property. Cabbage In India annual production of the cabbage is 9039.2 mt (5.5% of total vegetables production) from an area of about 0.400 mha (4.3% of total vegetable area) with the productivity of 22.6 mt ha-1. (Anon., 2018-19) and in the state of Chhattisgarh, the cultivation area of vegetable is 403.4 hectare and the production is 5565.9 mt with productivity of 13.5 mt ha-1. The contribution of cabbage in cultivated area as 23830 hectare and production 426078.00 mt ha-1.

Cabbage is a strong rearing crop that absorbs more NPK from the soil. In modern agriculture, the continuously use of chemical fertilizers, pesticides and herbicides give terrible affect to biodiversity and human health. There is lot of evidence of decreasing nutritional quality of fresh fruits and vegetables. The use of organic and biological fertilizers can improve soil health, growth, yield and quality, while avoiding chemical agriculture (Bahadur *et al.*, 2003) [2].

The organic manure alone also can't meet the immediate nutritional requirement of the crop. Therefore, integrated nutrient management is rising as an alternative for sustainable production of crops. It enhance the use of chemical fertilizer in conjunction with organic manure/ vermicompost, crop residue integration, and microbial inoculants, all of which are critical in maintaining agricultural soil fertility and production, as well as guaranteeing environmental safety. The use of renewable resources and renewable energy is the key point for sustainable agriculture with high productivity and less environment risk (Kizilkaya, 2008) [3].

Incorporation of FYM / vermicompost improves soil physical properties like stable soil aggregates, density, soil moisture holding capacity, soil air movement, chemical properties like buffering capacity, nutrient availability. As organic matters are the store house carbon and nutrients, which enhance the soil microbial population and their activity leads to maintain the soil healthy.

Methods and Material
The present investigation entitled "To study the effects of organic, inorganic and biofertilizer on yield attributes of cabbage (*Brassica oleracea var. capitata*)" was carried out at Horticulture Research cum Instructional Farm, BTC CARS, Bilaspur, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during Rabi season of 2020-21 which was located at 21˚16' N latitude and 81˚36' E longitude and at an altitude of 298 m above mean sea level.

The soil of the experimental site was sandy-clay in texture. The Cabbage (var. Green ball) was grown and treatments were replicated three times in RBD. The experiment consists of ten treatments *viz*., T1:- 100% RDF, T2:- 75% RDF + 25% N through FYM, T3:- 75% RDF + 25% N through Vermicompost (VC), T4:- 50% RDF + 50% N through FYM, T5:- 50% RDF + 50% N through Vermicompost (VC), T6:- 100% RDF + 25% N through Vermicompost (VC), T7:- 100% RDF + 25% N through FYM, T8:- 75% RDF + 25% N through Vermicompost (VC) + Azotobacter @ 2 kg / ha + PSB @ 2 kg / ha, T9:- 75% RDF + 25% N through FYM + Azotobacter @ 2 kg / ha+PSB @ 2 kg / ha and T10:- Control Plot. Where RDF (recommended dose of fertilizer) was 150: 100: 100 kg NPK / ha. The crop was sown on 28th November, 2020, transplanted on 20th December and harvesting was done on 03th March, 2021. The observations recorded at harvest were head formation percentage, head weight (g), head yield kg per plot and head yield q/ha.

Result and Discussion

The effect of INM on yield attributes and yields of Cabbage was studied and the results obtained were discussed as under. The integrated nutrient management indicated significant effect on yield attributes and yield of Cabbage crop (Table 1). The greatest head formation percentage (%) was noted in treatment T8 (100% RDF + 25% N through VC + Azotobacter @ 2 kg/ha + PSB @ 2 kg/ha) at harvest (96.5%) which was at par with T6 (100% RDF + 25% N through VC) (94.7%), T3 (75% RDF + 25% N through VC) (92.6%) and T5 (50% RDF + 50% N through VC) (90.5%). Essentially least head formation percentage (%) was noted in treatment T10 (control plot) (60.5%). In T8 (100% RDF + 25% N through VC + Azotobacter @ 2 kg/ha + PSB @ 2 kg/ha) head formation percentage increased by 13.10% while in T10 (control plot) it got reduced by 28.91% as compared to T1 (100% RDF) at harvest.

The head weight (g) goes from 484.5 g to 898.10 g at harvest. The most extreme head weight was noted in treatment T8 (100% RDF + 25% N through VC + Azotobacter @ 2 kg/ha + PSB @ 2 kg/ha) at harvest (898.10 g) which was at par with T5 (50% RDF + 50% N through VC) (803.2 g). Altogether least head width was noted in treatment T10 (control plot) (484.5g). In T8 (100% RDF + 25% N through VC + Azotobacter @ 2 kg/ha + PSB @ 2 kg/ha) head weight increased by 25.16% while in T10 (control plot) it got reduced by 32.4% as compared to T1 (100% RDF) at harvest.

The head yield (kg/plot) goes from 9.0 kg/plot to 31.1 kg/plot at harvest. The most extreme head yield was noted in treatment T8 (100% RDF + 25% N through VC + Azotobacter @ 2 kg/ha + PSB @ 2 kg/ha) at harvest (31.1 kg/plot). The following best return was recorded in T6 (100% RDF + 25% N through VC) (27 kg/ha) which was at par with T5 [(50% RDF + 50% N through VC) (25.9 kg/plot). Altogether least head yield across was noted in treatment T10 [(control plot) 9.0 kg/plot]. In T8 (100% RDF + 25% N through VC + Azotobacter @ 2 kg/ha + PSB @ 2 kg/ha) head yield (kg/net plot) increased by 39.4% while in T10 (control plot) it got reduced by 59.6% as compared to T1 (100% RDF) at harvest.

The head yield (q/ha) goes from 125 q/ha to 432.0 q/ha at harvest. The greatest head yield was noted in treatment T8 (100% RDF + 25% N through VC + Azotobacter @ 2 kg/ha + PSB @ 2 kg/ha) at harvest (432 q/ha). The following best return was recorded in T6 [(100% RDF + 25% N through VC) 375 q/ha] which was at par with T5 (50% RDF + 50% N through VC) (360 q/ha). Altogether least head measurement was noted in treatment T10 (control plot) (125.7 q/ha). In T8 (100% RDF + 25% N through VC + Azotobacter @ 2 kg/ha + PSB @ 2 kg/ha) head yield (kg/net plot) increased by 39.4% while in T10 (control plot) it got reduced by 59.6% as compared to T1 (100% RDF) at harvest.

Table 1: Effect of INM on yield attributes and yields of Cabbage

Treatments	Treatment details	Head Formation Percentage E (%)	Weight Per Head (g)	Head Yield (kg per plot) net plot	Head Yield (q / ha)
T1	100% RDF	85.1	717.54	22.3	310
T2	75% RDF + 25% N through FYM	81.4	676.55	19.7	274
T3	75% RDF + 25% N through VC	92.6	707.94	25.3	352
T4	50% RDF + 50% N through FYM	78	569.68	15.9	220.3
T5	50% RDF + 50% N through VC	90.5	803.2	25.9	360.3
T6	100% RDF + 25% N through VC	94.7	792.95	27	375.3
T7	100% RDF + 25% N through FYM	87.5	774.39	24.1	335.3
T8	75% RDF + 25% N through VC + Azotobacter @ 2 kg/ha +PSB @ 2 kg/ha	96.5	898.1	31.1	432
T9	75% RDF + 25% N through FYM + Azotobacter @ 2 kg/ha +PSB @ 2kg/ha	88.1	774.4	24.4	339.3
T10	Control plot	60.5	484.55	9	125.7
	Mean	85.5	719.9	22.5	312.4
	S.Em(±)	2	34.5	1.3	18.5
	CD (P=0.05)	6	102.5	4	54.9

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