



# **Effect of Organic Sources of Nutrition on Cabbage Production in Arunachal Pradesh, India**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

The present investigation was carried out during Rabi season of 2017-18 and 2018-19 respectively in Tirap district of Arunachal Pradesh to find out the best doses of Rock phosphate and FYM for cabbage production. Total three treatments-T<sub>1</sub> (Rock phosphate@ 375 Kg/ha + FYM @ 10 Tonnes/ha), T<sub>2</sub> (Rock phosphate@200 Kg/ha + FYM @ 10 Tonnes/ha) and T<sub>3</sub> (Control -no use of any manure & fertilizer) were replicated thrice during both years of study. The T<sub>3</sub> resulted maximum in all parameters viz. - maximum plant height (31.4 cm), average weight of head (304.7 gm), total yield (162.8 q/ha) and marketable yield (149.3 q/ha) while control yielded minimum (31.4 cm, 304.7 gm, 162.8 gm, 149.3 gm respectively).

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## 1. INTRODUCTION

Being a staple crop in the wintertime, cabbage (*Brassica oleracea* L. var. *capitata*) is rich in vitamins, minerals, fibre, and other nutrients and has some therapeutic benefits as well. However, because it feeds heavily, cabbage draws more nitrogen, phosphorus, and potassium from the soil. The overuse of chemical fertilizers, insecticides, herbicides, and other agricultural chemicals has had a negative impact on soil fertility, biodiversity, produce quality, and human health in modern agriculture. Furthermore, there is evidence that throughout the past 60 years, intensive agriculture has led to a decrease in the number of vitamins and minerals found in fresh fruits and vegetables. Together with enhancing soil health, growth, yield, and quality, the use of organic manures and biofertilizers helps steer clear of chemical-based farming. [1,2,3].

According to Magkos et al [4] foods cultivated organically are healthier and contain more vitamins and minerals than conventional crops. They also preserve veggies better when stored at room temperature [5,6]. Compared to conventionally produced crops, organically cultivated crops showed a higher dry matter content [7,8]. A substantial body of research has been conducted, and it has been shown that applying organic amendments and biofertilizers together or separately improved yield, affected qualitative characteristics, and improved soil health in a number of vegetable varieties [2]. Unfortunately, there is a dearth of knowledge on the impact of organic manures and biofertilizers on cabbage quality, which is why the current study was conducted.

In eastern parts of Arunachal Pradesh, cabbage grows during the winter season. It is high in fiber & minerals, low in fat, high in foliate, water & vitamin C. It processes high in nutritional density which protect a wider range of disease from cancer to cataract. It also supplies Potassium and calcium too to human body.

In Tirap district of Arunachal Pradesh; farmers do not use any type of chemical fertilizers by default. This leads low productivity of cabbage and all vegetables. Though different agencies like- dept of Agriculture/Horticulture/Krishi Vigyan Kendra has done a lot of efforts to educate farmers about scientific way to application of organic and inorganic fertilizers. Besides that, farmers could

not adopt as much needed. The vegetables and other field crops yield declined due to low fertility level of soil [9]. The organic manuring can play a vital role in sustaining soil fertility and crop production. It is well known fact that inorganic fertilizers are not a positive sign to crop production soil and human health, ecology too [10]. The integrated nutrient management is the best way to maintain the soil fertility as well as food quality too.

## 2. MATERIALS AND METHODS

Before the conducting of trials, a field survey was conducted to know the real status about farmers practices of cabbage cultivation. As per the result of the survey; farmers were using undescribed variety, their seed rate was so high, plant spacing was wider than recommendation, no use of nutrients and plant protection measures in cabbage crop (Table 1).

The severity of problem regarding improper/not using of organic fertilizers was reported 40 % in the district. Too keeping all these facts, the Krishi Vigyan Kendra - Tirap, Deomali- Arunachal Pradesh conducted On Farm Trials (OFT) in Rabi season of 2017-18. And 2018-19. Respectively. The OFT conducted in five location (0.10 ha) in five selected villages namely - Lekhi village, Nutan Basti, Noitong, Mopaya and makat. All the selected farmers were educated through training program. The soil of the district is silt clay loam type having pH 5.8 (based on soil testing result in KVK Tirap). The plot size of every selected farmer was 0.02 ha. The fields were weed free, well ploughed & levelled.

The Randomized Block Design with three (03) treatments and three (03) replications were applied. The first Treatment details are as follows- T<sub>1</sub> (Rock phosphate@ 375 Kg/ha + FYM @ 10 Tonnes/ha), T<sub>2</sub> (Rock phosphate@200 Kg/ha + FYM @ 10 Tonnes/ha) and T<sub>3</sub> (Control - no use of any manure & fertilizer). Rock phosphate in powdered form @ 375 Kg/ha was applied during last ploughing. Golden Acre variety was growing at Nursery of Krishi Vigyan Kendra- Tirap during second week of October, 2017. The 25 days old seedlings were distributed to every selected farmer and transplanted @ 45 cm x 30 cm spacing, during the 1<sup>st</sup> week of November, 2017 and 2018 respectively. All the scientific package and practices were applied during the crop duration.

**Table 1. Package and Farmers' Practices demonstrated in Brinjal FLD**

Particular	Technological intervention	Existing practices	Gap
Variety	Golden Acre	Low yielding variety	Full gap
Seed rate	500 g /ha	900 g /ha	Partial gap
Seed treatment	Seed was treated	Not treated	Full gap
Transplanting method	Transplanting on raised bed	Flat bed	Full gap
Spacing	60 cm x 20 cm	80 cm x 30 cm	Partial gap
Application of recommended dose of manure	5 kg/ meter <sup>2</sup>	Nil/without recommendation	Partial gap
Application of Bio fertilizer	Soil application of Azospirillum & PSB @ 2 kg/ha mix with FYM	No application	Full gap
Plant protection measures for control of insect pest and disease	Need based application of plant protection bio- pesticides for control: Fruit fly, mites and sucking pest - Spray of 5 % NSKE	Not followed, any type of spray	Full gap
Harvesting	Manual	Manual	No Gap

**Table 2. Soil composition of Tirap district, Arunachal Pradesh**

Soil Characteristics	Analytical value
<b>Physical Properties</b>	
Sand	17.1 %
Silt	47.3%
Clay	35.6%
Texture	Silt clay loam
Bulk density	1.4 gm/cm <sup>3</sup>
Particle density	2.6 gm/cm <sup>3</sup>
<b>Chemical Properties</b>	
Soil pH	5.8
Total N (%)	0.058 %
Organic carbon (%)	0.8 %
C: N ratio	13.79
Available P <sub>2</sub> O <sub>5</sub> (ppm)	12

**Table 3. The weather during the research period**

Month	Rainfall(mm)		Temperature °C				Relative Humidity (%)			
	2017	2018	2017		2018		2017		2018	
			Max.	Min.	Max.	Min.	M	E	M	E
April- 2017	247	186.0	34.4	12.2	35.2	13.2	82	67	81	65
May- 2017	327	117.5	35.6	14.6	36.7	15.1	86	73	89	75
June-2017	241	433.4	36.8	16.5	37.7	17.2	91	80	93	82
July-2017	347	336.6	34.2	18.4	35.4	18.9	93	83	95	81
August-2017	493	277.3	33	19.1	34.2	20.1	87	85	89	87
September-2017	371	186.2	32.3	18.8	33.6	20.1	88	84	91	86
October-2017	162	118.0	26.5	17.2	27.4	18.4	89	90	92	92
November-2017	7.6	15.4	25.1	12.3	25.9	14.1	87	82	89	88
December-2017	0	0	25.8	9.4	26.2	10.2	85	83	86	87
January- 2018	12.2	12.7	25.4	8.6	26.2	9.1	85.7	88	84.9	88
February-2018	69.6	69.0	26.1	7.9	26.9	8.3	88	90	83	92
March-2018	138.2	123.0	28.7	8.8	29.1	9.2	85	81	82	83

Where Max. denotes maximum, min. denotes minimum, M denotes Morning, E denotes evening

**Table 4. Result on growth & yield of cabbage influenced by different doses of Rock phosphate and manures**

Treatments	Results of parameters (Pooled data of 2017-18)			
	Plant height (cm)	Weight of head (gm)	Total yield (q/ha)	Marketable yield (q/ha)
T <sub>1</sub>	31.4	304.7	162.8	149.3
T <sub>2</sub>	29.7	268.2	148.6	137.6
T <sub>3</sub> (Control)	26.5	219.1	121.3	103.4
CD (5%)	1.87	22.36	14.79	9.76

T<sub>1</sub> – Rock phosphate @ 375 Kg/ha + FYM @ 10 Tonnes/ha, T<sub>2</sub>- Rock phosphate @ 200 Kg/ha + FYM @ 10 Tonnes/ha, T<sub>3</sub>- Control (no use of any manure & fertilizer)

In Arunachal Pradesh three types of Agro-climatic zones are prevails. the Tirap district falls under Eastern Himalayan Region (Zone II), Sub region:- Per Humid Hyper Thermic Foothills; where hot and humidity is very common characteristics. The rains start from End of February and continue up to September. The intermediary dry spells are often occurs which are very heat and humid.

### 3. RESULTS AND DISCUSSION

The T<sub>1</sub> recorded maximum plant height (31.4 cm) followed by T<sub>2</sub> (29.7 cm) meanwhile control was the minimum (26.5 cm). The significant variation 1.87 was observed regarding plant height of cabbage when two different doses of rock phosphate with manure were applied in soil. Under the treatment control; where no rock phosphate and manures were applied; the result was minimum. The organic manures improve the water holding capacity, availability of nutrient supply, soil porosity, cation exchange capacity of soil; which resulted into better result; where it had applied in sufficient amount [11]. The Ditta et al. [12] have reported that enriched rock phosphate along with fertilizers had improved the lentil yield and productivity.

The weight of head was maximum (304.7 g) recorded with T<sub>1</sub> followed by T<sub>2</sub> (268.2 g) while the control was poorest (219.1 g). The combined effect of rock phosphate and manures exhibited remarkable positive result in head weight of cabbage. The organic fertilizers can apply as alternative of inorganic fertilizers for soil biomass as well as better yielding of crops. The result is also confirmed by Dauda et al. [13] and Ditta et al. [14].

The maximum total yield of cabbage (162.8 q/ha) followed by T<sub>2</sub> (148.6 q/ha) meanwhile the control yielded least (121.3 q/ha). The yield parameter was statistically significant. This result

is also in confirmation of Noor et al. [15]. The Organic manures improved the soil microbial activity; resulted better availability of soil nutrients, good air availability for root zone hence the yield increased. Ditta et al. [16] has also revealed that application of rock phosphate enhanced the availability of phosphorus; which resulted into better root development, enhanced the water intake capacity, nutrient intake capacity. Allah Ditta et al. [17]. Has also reported that rock phosphate played important role for providing available form of phosphorus in legume crops; which recorded good yield.

Similarly, the marketable yield was also recorded highest with T<sub>1</sub> (149.3 q/ha), followed by T<sub>2</sub> (137.6 q/ha) meanwhile the minimum marketable yield (103.4 q/ha) was yielded by control. Due to different doses of rock phosphate and FYM; the marketable yield statistically significant. These results are in confirmation with Das et al. [18], Farooq et al. [19] and Kamal et al. [20].

### 4. CONCLUSION

After the results of two years of study; it has been established that balance dose is vital component in cabbage production. The farmers are needed to educate these findings through different extension approaches to enhance their farm productivity. Following points have been concluded in this study

- Treatment number three (Rock phosphate @ 375 Kg+ FYM @ 10tonnes/ha) yielded 162.8 q/ha cabbage which was maximum.
- Treatment number two (Rock phosphate@200 Kg/ha + FYM @ 10 tonnes/ha) yielded 148.6 q/ha cabbage which was second.
- The control (no use of any manure & fertilizer) yielded 121.3 q/ha cabbage which was lowest.

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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