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Review Article

A Project work on production of Cauliflower (Brassica oleracea var. Botrytis) variety "Pusa Kartiki" under Treatment by FYM, Vermicompost, Bio Fertilizer and NPK at IAAS Paklihawa

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Abstract: A variety of Brassica oleracea, Pusa Kartiki which is an early season variety if grown commercially in Terai condition can give higher return to a farmer. A project work was carried out from 8th of Ashoj 2072 to 15th of Magh 2072 at IAAS, Paklihawa Campus Horticulture Farm by the students of B.Sc.Ag.5thSemester. The main objective was to observe the cauliflower production under the observation trail by FYM, VERMICOMPOST, BIOFERTILIZER and NPK. Apart, our aim was also to know about commercial production of cauliflower and developing entrepreneurship skill among the students. The variety cultivated was PusaKartiki. The source of fertilizer used was FYM and NPK on calculated basis. We were allocated 5 x 5 m2plot. The plot was separated from others by 50 cm bunds. Cauliflower was cultivated in 10 rows with the spacing of 50cm *50 cm. Within the plot of 25m2 area 42.288 kg cauliflower was harvested which was approximate 16.915 ton/ha.The loss due to diseases and nutrient deficiencies were recorded and their management practices were carried out to some extent. The main aim of the project was to know the production, productivity and profitability of the cauliflower cultivation under the application of different fertilizers at different doses in the condition of IAAS, Paklihawa horticulture farm.

Keywords: Cauliflower; Pusa Kartiki; Cultivation; Fertilizers; Production

Introduction

Cauliflower is one of several vegetables in the species Brassica oleracea, in the family Brassicaceae. It is an annual plant that reproduces by seed. Typically, only the head (the white curd) is eaten. Cauliflower is low in fat, low in carbohydrates but high in dietary fiber, water, and vitamin C, possessing a high nutritional density.

Cauliflower is one of the most important cool season vegetable crops grown throughout the country and relished by most of the people. Being a heavy feeder, cauliflower demands constant supply of large amount of nutrients and water for its luxuriant growth. A yield of 50 t/ha of cauliflower removes apparently 200kg nitrogen, 85 kg phosphorus and 279 kg potassium (Chaudhary, 1977). Its productivity depends upon the balanced fertilizer and if not adequately fertilized, considerable yield losses are apparent (Chatterjee, 1993).

In the context of Nepal, cauliflower is grown as both seasonal and off-seasonal vegetable. It is grown during cool summer months in higher elevations and can be successfully grown in winter in the tropical regions. It is cultivated in 34,065 hectares of land with the annual production of 524,205mt. (MOAD 2012/13). Whereas in Rupandehi district, it is cultivated in 915 hectare with 19,490mt annual production thus productivity of 21mt/ha. Bio-fertilizers are still not being used in a large scale except some subsistent progressive farmer despite of its cost effectiveness and eco-friendly nature. Within this area there is no speciation of use of bio-fertilizer. Above every hectare of land there is 7800 tons of atmospheric nitrogen which is equivalent to 170,000tons of urea (Mostara 1999) but the capacity of utilizing this free nitrogen is limited to certain prokaryotic organism which is the basic component of bio-fertilizers. The acceptability of bio-fertilizer is low because farmers are unaware of the benefit of the integration of bio-

fertilizer into the soil. Thus, an experiment is carried out to know the performance of Pusa Kartiki variety of cauliflower.

Systematic Classification

Kingdom: Plantae

Phylum: Magnoliophyta

Class: Magnoliopsida

Order: Brassicales

Family: Brassicaceae

Genus: Brassica

Species: oleracea

Common Name: Cauliflower

Nepali Name: Kauli/ Fulgovi

Figure 1: Cauliflower head.

Botany

Cauliflower is a herbaceous annual for vegetable production and biennial for seed production. The term cauliflower is derived from two Latin words namely 'Caulis' meaning cabbage and 'Floris' meaning flower. The edible portion of cauliflower in the white curd like mass composed of a close aggregation of abortive flower developed on thick bunches of the inflorescence. This edible portion is called 'Curd' surrounded by leaves which are longer but narrower than those of cabbage.

Climatic Requirements

Cauliflower is thermo-sensitive crop and requires cool moist climate. The early varieties may tolerate higher temperature and long days. The temperature requirement depends upon the maturity group. It may transform curding from 5ºC to nearly 28-30ºC. The optimum temperature for young seedling is 23ºC. Early variety requires high temperature in short days. At relatively lower temperature, the curds of early varieties become riceyness, leafy, loose and yellow resulting in low quality. At low temperature curds of late varieties remain under sized or small, showing some signs of bolting. In hot and dry weather, the curd becomes small and hard. Thus it is very essential that early, main and late varieties are planted at proper time.

Soil and its requirement

It can be grown on a wide range of soil provided that they are rich in nutrients and have adequate soil moisture, possess a good drainage and also contain plenty of organic matter. Sandy loam soil are preferred for early crops, while loam and clay loams for late crops. Cauliflower grows best on a neutral to slightly acid soils i.e. at PH 6.0 to 7.0. If the soil is below PH 5.5 liming at the rate of 5 to 10 quintal per ha should be done for successful raising of cauliflower. Higher PH than 7.0 decrease the availability of boron. The soil must be thoroughly prepared to make it loose and friable, and retentive of moisture. Basic organic manures should be applied during the field preparation.

Objective

- To be able to know the scientific cultivation practices of cauliflower
- To know about the different stages of cauliflower
- To be able to handle a vegetable production plan from field preparation to marketing
- To be familiar with the problem and constraints during the production of cauliflower
- To be acquainted with the marketing of the cauliflower
- To test the yield with different treatment of fertilizer dose.

Methodology

Site selection

The experimental site for the cauliflower cultivation was allocated at the Horticulture farm of IAAS, Paklihawa. This site is located about 4 km south west from Bhairahawa. The altitude of this site is about 256 meter above sea level (m.a.s.l.) with 27° 30' 0" N latitude and 83° 27' 0" E longitude. Our plot was at about the middle of the Horticulture farm. We the students of 5th semester

was given a plot of 5 x 5 m2 for the purpose of observing different growth stages of commercial vegetables, its production and marketing under the supervision of our respected Prof. Dr. Kanhaiya Prasad Singh. Different tasks were performed for the cultivation of cauliflower.

Materials required

- Wooden pegs, Basket, Gunny thread, Stakes, Kuto, Spades, Khurpi, Sickle, Measuring Tape, Watering Can, Irrigation Pipe, Weighing Balance, Organic Fertilizer etc.
- Fertilizer (NPK), FYM, boron, seedlings of cauliflower, etc.

Plot design

The plot of (5 × 5) m^2 was prepared for the cultivation of cauliflower. The bund of 30cm was made for the separation of our plot from other plots. Total 10 rows and 10 columns were made to plant the total 100 seedlings of cauliflower. Each row and column were separated by 50 cm from each other on all the sides except the first row and column of the square shaped plot. The distance of first row and column of the plot was maintained at 25 cm from the bunds on all sides. The plot was designed with the help of measuring tape and gunny thread. Marking of the spots and the boundary was made with help of wooden pegs. The layout of the plot is shown below (Figure 2).

Figure 2: Layout of field for 5m*5m for cauliflower plantation.

Land preparation

The land provided to us was initially tilled by the tractor at the depth of about 15 cm by the campus administration during the month of Bhadra. to the individual plot of 5m × 5m was done by all the student of the project work in coordination with Mr. Rupesh Singh. The condition of the field when we started our operation was full of weeds, clods and unlabelled. The plot was separated from others by 50 cm bunds on all the sides. Then the plot was again ploughed twice, and all the weeds were removed, the clods were broken, and the soil was pulverized. A well decomposed recommended dose of FYM, BIOFERTILIZER and VERMICOMPOST was incorporated in the soil along with the basal dose of urea and full dose of DAP and MOP which was followed by the hoeing and levelling off the field by rake. The land preparation was done on ashoj12th 2072.

Figure 3

Transplantation

The seedling of Pusa Kartiki variety of Cauliflower was provided to us. It was prepared by department of Horticulture itself on raised nursery seedbed as per recommended procedure. The seedling provided to us was aged about 20 days. The seedlings when uprooted for transplanting were nearly 10 cm height and 4-5 leaf stage. On 2072 Ashwin 16ththe seedlings were transplanted in the project plot. The spacing was 50 cm x 50 cm RR and PP. The seedling was transplanted at the depth of 5-7 cm. Irrigation was provided immediately after transplanting with fine rose of water with the help of watering can in the evening. The seed sowing was done by the department of horticulture in the raised nursery bed as per the recommended procedure. The seed was sown on 15th Bhadra 2072. The seedling provided to us was about a month old. The seedlings uprooted at the time of transplanting were about 10-12 cm in height and the seedlings were 4-6 leaf stage. The seedlings were transplanted on 16th Ashoj 2072.

Seedling Requirement

- **No. of Seedling:** 100/25m2 (3 seedlings were transplanted as extra for gap filling if needed in case of seedling mortality)

- **No. of rows:** 10
- **No. of seedling per row:** 10.

Figure 4: A day old planted Cauliflower.

Spacing

- **Row to row:** 50cm
- **Plant to plant:** 50cm

The spacing between the first row and column with the bund is 25 cm on all the 4 sides.

Depth of seedling transplanted

5-7 cm from the leveled surface

Seedlings requirements

Total number of seedlings required was 100 for planting in 10 rows and 10 columns. Some insurance plants were also taken in case for re-sowing due to seedling mortality. About 10 seedlings were taken as the insurance plant.

Treatments

S. N	Indication	Treatment	Recommended Dose
1	T_1	NPK+ Bio fertilizer	200:120:80 Kg NPK/ ha + 15 ton/ha
2	T_2	NPK+ Vermicompost	190:110:70 Kg NPK/ ha + 4 ton/ha
3	T_3	FYM+ NPK	15 ton/ ha+180:100:60 Kg NPK/ha
4	T_4	FYM + Vermicompost + Bioferilizer + NPK	5 ton/ha ++ 1.3ton/ ha + 5ton/ha + 170:90:50 Kg NPK/ha

Table 1

Fertilizer application

Fertilization was completely based on the treatment provided and its recommended dose. Our treatments were Farm Yard Manure (FYM) and NPK @ 5-ton FYM/ha and kg 170:90:50 NPK/ha respectively. Borax was also applied @ 15 kg/ha. The fertilization was done in two split doses initial during the field preparation and another 25-30 DAT.

Calculation of fertilizer requirement for 25m^2 based on the given recommended dose

Fertilization	Required Amount (25m^2)
Farmyard Manure	12.5 Kg
Urea	732 gm
DAP	492 gm
MOP	208 gm
Borax	37.5 gm

Table 2

Intercultural operations

- **Gap Filling:** Some seedlings in the plot were not established properly due to damping off and other various problems. So about 10 seedlings were re-sown in the initial area of the previous from the insurance plant stock.
- **Irrigation:** Irrigation was done immediately after the transplanting of the seedling. Daily irrigation was given for the first week till the establishment of the seedling in the field. Then the irrigation was given at an interval of about a week. The irrigation was done during the evening after the sun set. The irrigation was done with the help of watering can and bucket and mug. The source of water for irrigation was from the nearby pond of the horticulture farm.
- **Earthing up and hoeing:** Earthing up and hoeing was carried out after 30 days of transplanting with the help of hand hoe.
- **Weeding:** First weeding was carried out along with earthing up and hoeing at same time. The major weeds identified in the plot were *Cynodon dactylon, Chenopodium album, Rumex nepalensis* and few other broad-leaved weeds. And second weeding was carried out after 30 days of first weeding.

Diseases and Disorders

Damping off

During the transplantation of the seedlings, this was observed. So new seedling was replaced in such cases. During the replace-

Figure 5

ment process each of the replaced plants are marked with the sticks so that it is totally identified. On the time of sampling the plants which are affected by damping off were not taken.

Figure 6: Damping off observed in field.

Alternaria Leaf Spot

Alternaria was observed at the harvesting stage of Cauliflower. Though no major effects were seen on cauliflower, but it was one of the reasons for quite inadequate production of cauliflower.

Browning (Disorder)

Due to the boron deficiency browning was seen in some plants but not such effect was seen. On the maturing stage of the curd the deficiency is also seen. It is characterized by the browning of the portion of the curd so that there is change on the color of the curd. After cutting the stalk of the curd we can also identify the symptoms.

Plant protection

No any particular insect/pest was observed in the field. Although Alternaria leaf spot and brown ring spot were observed, no any chemical measures were applied since these diseases inflicted no any significant losses in the production of cauliflower.

Figure 7: Alternaria leaf spot in the field.

Figure 8: Boron deficiency seen in seedlings.

Harvesting and marketing

Harvesting of the cauliflower was done when the curd attained proper size and compactness. The harvesting indices of the cauliflower was observed when the lowermost part of the curd was about to unfastened from the compactness. The harvesting of the cauliflower was done from the base of the plant with the sharp knife. First harvesting of the cauliflower was done on Poush 19th, 2072.

Harvesting of the cauliflower was done several times due to the unequal maturing of the curd. The harvested cauliflower was handed to the department of horticulture for the marketing. The selling price was also fixed by the department of horticulture according to the market price.

Observation

Yield: From the project work of cultivation of the cauliflower, we became able to calculate the total marketable yield of cauliflower, including its biomass. Of the total 100 plants, the detail data and information of 10 plants were taken that helped us to analyze the total biological yield as compared to that of marketable yield. Some detail observation of 10 plants is shown in the following table 3.

From the above table it has been found that the total biomass and total yield is found to be 135.238 and 42.288 respectively. On the context of the curd depth and the curd diameter it is found to be 11.44 cm and 13.73cm respectively. The average number of leaf is found to be 15.3 with 54.5 cm and 16.3 cm leaf length and leaf breadth respectively.

Date of Harvest	Trt	Ph	Ps	Plant No.	Bio-mass (kg)	Mkt yield (kg)	Curd depth (cm)	Curd Dmr (cm)	Tot no of leaf	Leaf Length (cm) Avg	Leaf Breadth (cm) Avg
072/9/21	T_4	68	99	1	3.21	1.05	13	16	19	61	18
072/9/21	T_4	76	81	2	1.4	0.62	11.5	15.5	11	54.6	17.9
072/9/21	T_4	66	86	3	1.25	0.5	11	11	14	46	14.6
072/9/21	T_4	51	72.5	4	1.3	0.53	12.8	13	16	44	15.2
072/9/21	T_4	81	96.5	5	1.86	0.45	9.7	12	19	60	14.8
072/9/21	T_4	77	94.5	6	1.76	0.41	12.5	14.6	13	53.4	15
072/9/26	T_4	74	77	7	1.25	0.63	12	16.5	15	63	16.1
072/9/26	T_4	74	91.5	8	1.76	0.39	9.9	12.2	16	57.4	16
072/10/2	T_4	81	90	9	2.571	0.659	12.5	15	16	54.2	19.2
072/10/6	T_4	76	86	10	2.033	0.808	9.5	11.5	14	51.4	16.2
Total (Mean)		**72.4**	**87.4**		**1.839**	**0.603**	**11.44**	**13.73**	**15.3**	**54.5**	**16.3**
072/10/10					33.312	11.07					
					21.61	6.386					
					25.097	8.396					
					8.024	2.29					
					11.274	1.374					
					17.527	6.725					
Total Yield					135.238	42.288					

Table 3: Observation of different attributes of Cauliflower (Brassica oleracea var. botrytis) by FYM, VERMICOMPOST, BIOFERTILIZER AND NPK @ 170:90:50 kg NPK/ha

Note: Trt= Treatment, Ph=Plant Height, Ps=Plant Spreading, Mkt = Marketable, Dmr=Diameter

Yield Analysis and Discussion

Recommended yield from the field = 20 ton/ha

In 25 m^2 the yield should be 0.05tons= 50 kg.

Here,

Total yield obtained= 42.288 kg

Yield obtained per hectare= 16.915 tons/ha

Average yield

Total number of standing plants till harvesting stage = 98

Yield from plot = 42.288 kg

Avg. Yield per plant= 42.288/98 = 0.4315 kg = 431.5 gm.

Thus, the observed loss in yield of the cauliflower in the field was accompanied by the combined effect of several factors. Those

factors may be biological, cultural, etc. From the beginning of the project work till the final harvest of the cauliflower many factors were responsible for the poor yield of the cauliflower. Those factors can be enlisted and discussed as under:

- **Purity of variety:** The impurity of variety was one of the major causes of the poor yield of the cauliflower. During the course of harvesting the morphological similarities between the different curds were seen.
- **Poor management practice:** It was also one of the constraints in the production of the cauliflower. Many of the cultivation practices practiced do not occur simultaneously in accordance with the growth stage of the crop as one-month long India tour coincided with the growth period of cauliflower.
- **Application of fertilizer:** The fertilizer application was also not in accordance to recommended time period. The application of urea was recommended to be applied at three split doses but its application was done only at two split doses. This resulted at the excessive vegetative growth and poor formation of the curd.
- **Nutrient Deficiency:** The nutrient deficiency such as browning due to deficiency of boron also occurred the field due to which it has caused the discolor of the leaf into the purple color and the heart of the stem has also the blackish color [1-4].

Conclusion

Hence, after the completion of the project work, we are now able to know the cultivation practices in the production of the early season cauliflower variety "PusaKartiki" under recommended management condition. We were also able to know the insect, pest, diseases and also the nutrition deficiency symptoms that occur during the cultivation of the cauliflower variety and their management practices. Although the average production does not coincide with the recommended yield, the production was found to be satisfactory. Overall, we were also able to study about the effect of different dose of fertilizers on cauliflower production at the field condition of the Vegetable Section, Horticulture Farm, IAAS Paklihawa.

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