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Original Article

Effect of Organic Manure and Biofertilizer on Yield and Yield Components of Mustard (*Brassica Juncea*)

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Abstract

Effects of organic manure and different types of microbial biofertilizers were studied on growth and yield of Mustard (*Brassica juncea*). The experiment was conducted during Rabi season 2014-15 at the research field of Patanjali Bio Research Institute, Haridwar, Uttarakhand. The mustard cultivar Pusa 27 (EJ-17) was used in the study. The field experiment was laid out in Randomized Block Design (RBD) with four treatments and three replications along with one control. Different morphological parameters were taken and mean of observed value recorded. Tallest plant of size 48.4 inches was found on 65 Days After Sowing (DAS) for Treatment T3 (Carbon 24%, Nitrogen 2.25 %, Phosphorus 2.75%, Potassium 1.775 %, Calcium 3%, Magnesium 0.45%, Sulphur 0.4%, Iron 0.6%, Zinc 0.35%, Manganese 0.09%, at the rate of 101 Kg acre^{-1}, Humic acid 4.0% at the rate of 12.7 Kg acre^{-1} , Amino acids 0.3% at the rate of 12.7 Kg acre^{-1}, Lignite, Dolomite, Calcium carbonate, Trichoderma Sp., Pseudomonas Sp., Azotobactor Sp. at the rate of 760 ml acre^{-1}) and the shortest plant oh height 39.6 inches in control. Maximum number of flower 27 in T3, whereas minimum number of flower 15.6 in control. The result showed that application of microbial biofertilizers significantly increased the total grain yield. The maximum grain yield 10.33 quintal acre^{-1} was recorded in treatment T3 in comparison to 6.33 quintal acre^{-1} for control.

Keywords

Mustard; Bio-Fertilizer; Organic Fertilizer; Yield.

Introduction

Mustard (*Brassica juncea*) belong to the member of Brassicaceae family [1]. Indian mustard is commonly known as rapeseed-mustard, and grown in more than 50 countries globally [2, 3, 4]. Oilseed mustard is grown predominately in Indian subcontinent than vegetable and condiment [5]. India holds first position in term of cultivated area and second position in term of production of oilseed mustard [6]. In world it holds third position as oilseed crops just lagging behind with soybean (*Glycine max)* and palm oil. The Indian mustard cultivated in almost all states of India but majorly cultivated in Rajasthan, UP, Haryana, Madhya Pradesh, and Gujarat [7, 8]. It is an herb growing up to 1.0 miter or more tall. It bears long and erect branches [9]. It is used in different form like vegetable, condiment and oilseed. It is one of the world's most important spice crops. Recently mustard has been increasingly used in food preparation for its unique properties. Mustard also has many applications outside of traditional food ingredient uses. Some types offer biological and insecticidal properties and the oil can be used in the manufacture of biodiesel and other industrial products. Yellow or white mustard, used in traditional hot dog mustards (*Sinapis alba*), oriental mustard used in oriental mustards (*Brassica juncea*) and brown mustard used in Dijon style mustards (*Brassica juncea*). The fatty oil extracted from the mustard seeds has found to be dark yellow in colour and pungent in test. There are three types of mustard oil categorized on the basis of

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extraction process. By the mustard seed processing, we get fatty vegetable oil, the second is an essential oil which is made by seeds grinding and third is a mixture of different other vegetable oils such as soya bean. The mustard oil is beneficial for skin, stimulates sweet glands, and may be used to treat the skin rashes and infection. It is also beneficial for hair care, overcome dry lip problem, used as natural sunscreen, has anti-inflammatory, anti-bacterial and anti-fungal properties and traditionally used to cure many diseases like Asthma, cold and cough, Malaria etc. Nutritionally it contains 60% monounsaturated fats (MUFA), 21% polyunsaturated fats (PUFA) and 12% saturated fats [10].

Organic agriculture mainly focuses on the maintenance of high soil microbial activity to improve soil quality [11]. Use of Inorganic agro-chemical in the agricultural field leads to many health related problem and may cause depletion of soil nutrients and beneficial micro flora [12,13]. The problems caused by chemical fertilizer may overcome by using organic manure, biofertilizers because they possess many desirable soil properties [14]. Recently many study proved that the application of organic manure and biofertilizers can substantially enhance production of mustard by improving the soil physical, chemical and biological condition. Biofertilizer fulfill the plant nutrient requirement by biological nitrogen fixation, solubilizing inorganic phosphorus into bioavailable and by decomposition of biomass [15].

Fig. 1: Mustard field view

Materials and Methods

This experiment was conducted in order to investigate the effect of organic manure, biofertilizers and growth promoter developed by Patanjali Bio Research Institute, Haridwar, Uttarakhand, India. The experiment was carried out at Patanjali Bio-Research Institute located within the Padartha campus of the Patanjali Food Park. The experiment was concurrent with the winter agriculture season of Haridwar district, for the financial year 2014-15. A modified Random Block Design (RBD) was used for design of the experiment plots. The experiment design had five treatment including control (To, T1, T2, T3 and T4) as listed in table 1. The treatments composition and their dose were applied as presented in table 1. The total extend of the land under

Table 1: Composition of different treatments

Sl. No.	Treatment	Composition	Application rate acre-1
1.	T0	Decomposed Cow Dung	8 ton
2.	T1	Carbon-24%, Nitrogen-2.25 %, Phosphorus-2.75 % , Potassium-1.775 %, Calcium-3%, Magnesium-0.45%, Sulphur-0.4%, Iron-0.6%, Zinc-0.35%, Manganese – 0.09%, Copper, Boron, Cobalt & molybdenum in trace amount	101 Kg
		Humic acid-4.0%	12.7 Kg
		Amino acids -0.3%	12.7 Kg

3.	T2	T1	3034 Kg
		Azobactor crococcum (CFU-10^8)	890 ml
		Bacillus megaterium (CFU-10^8)	4550 ml
4.	T3	T1	3034 Kg
		Rhizobium sp.	632 ml
		Lignite, Dolomite, Calcium carbonate, Trichoderma Sp., Pseudomonas Sp., Azotobactor Sp. (CFU-10^8)	760 ml
5.	T4	T1	3034 Kg
		Azobactor crococcum (CFU-10^8)	890 ml
		Lignite, Dolomite, Calcium carbonate, Trichoderma Sp., Pseudomonas Sp., Azotobactor Sp. (CFU-10^8)	760 ml
		Bentenoite sulphur-90 %	12.7 Kg

cultivation was around 320 m^2. Plot size was 32 m^2.

The Mustard cultivar Pusa 27 (EJ-17) was used in the study. The seeds (sown in T1, T2, T3 and T4 treated plots) were treated with the mixture of Bio-fungicide (*Trichoderma sp.*) at the rate of 5 ml per liter for 10 minute, and water was used to treat the seeds for control for 30 minutes before sowing. The sowing was done on 1st December 2014. Irrigation and weeding were done regularly.

The neem oil (5 ml / L) was applied once to control the insect. The intermediate application of biofertilizers and growth promoters was given two times, first on 22 DAS (Days after Sowing) and second on 50 DAS. The intermediate treatment was given as per table 2.

Table 2: Intermediate treatment application.

Treatment	Material	Quantity
T0	NA	NA
T1	Humic + Sujeeva	3 ml / L each
T2	Humic + NPK	3 ml / L each
T3	Sujeeva + Sulphur	3 ml / L each
T4	Sujeeva + NPK	3 ml / L each

Results

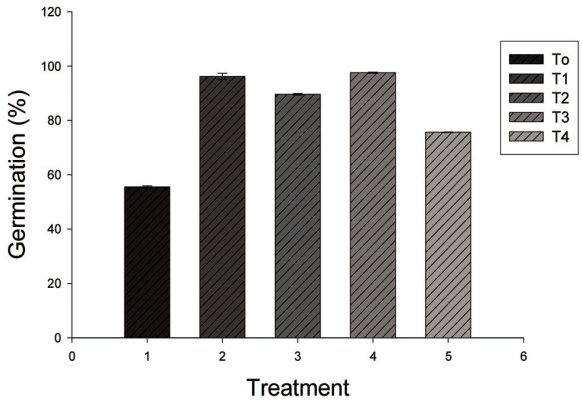
Seed Germination

Seed germination count was taken on 15 DAS. Germination percentage was calculated on the basis of seed rate. The seed rate per plot was 12.5 gm, and the number of seeds in 1 gm of seeds was 142, hence total seeds per plot were 3025. To count the seed germination 1X1 m^2 area was selected randomly from each plot and number of plants was count for this area and then multiplied by 32 (plot size 32 m^2). The maximum seed germination 97.58 % was obtained for treatment T3 followed by 96.19 % for T1 in comparison to 55.52 % of control.

Table 3: Plot wise Seeds germination.

Treatment	Germination %
T0	55.52±0.41
T1	96.19±1.18
T2	89.61±0.30
T3	97.58±0.18
T4	75.64±0.13

Values are means ± SE



Graph 1: Seed germination percentage

Plant Height

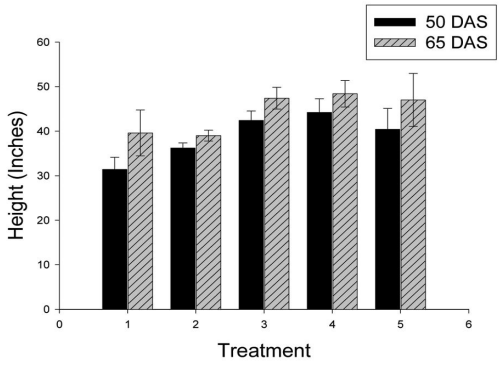
Plant height was taken two times. First observation was conducted on 50 DAS and the second on 65 DAS. To determine the plant height, five plants were chosen randomly from each treatment. Plant height was recorded in inches as presented in table 4 and graph 2. The tallest plant was recorded in T3 (44.20 inches on 50 DAS and 48.4 inches on 65 DAS) and the smallest plants

Table 4: Plant height in randomly selected plants per treatments. Values are means ± SE.

Treatments	Plant height (Inch) after 50 DAS	Plant height (Inch) after 65 DAS
T0	31.40 ±2.7313	39.00±5.1536
T1	36.20±1.1576	39.06±1.2247
T2	42.40±2.1354	47.40±2.4413
T3	44.20±3.0561	48.40±2.9766
T4	40.40±4.7074	47.00±5.9498

Values are means ± SE

found for T0 (31.40 inches on 50 DAS and 39.0 on 65 DAS). There was no significant difference found between T2, T3 and T4 indicate that microbial biofertilizers will helpful in morphological growth of this crop. Growth pattern was almost linear from 50 DAS to 65 DAS.



Graph 2: Plant height per treatment

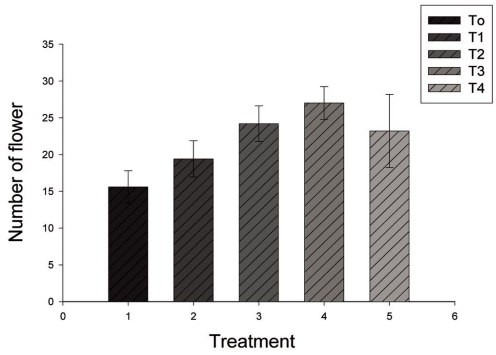
Number of Flower

Number of flowers per plants was observed for each treatment. Randomly five plants from each treatment were taken and the mean value calculated as presented in table 5 and graph 3. Maximum numbers of flower 27 were observed in T3, whereas minimum 15.6 was for T0. T3 was significantly higher than other treatment, whereas T2 and T4 were non-significant to each other but found significantly higher than control and T1. The result obtained showed that the application of microbial biofertilizers significantly enhanced the flower number.

Table 5: Number of flowers in randomly selected plants per treatments.

Treatments	Number of flowers/plant
T0	15.60±2.2045
T1	19.40±2.4617
T2	24.20±2.4372
T3	27.00±2.2361
T4	23.20±4.9739

Values are means ± SE

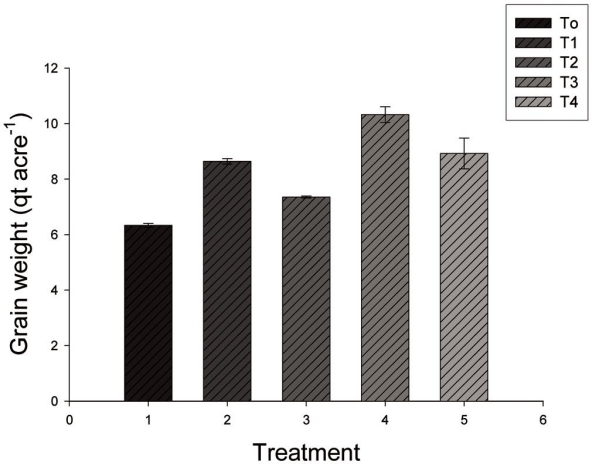


Graph 3: Number of flower plant-1

Table 6: Grain weight per treatments.

Treatments	Total weight (quintal acre^{-1})
T0	6.33±0.07
T1	7.35±0.04
T2	8.64±0.09
T3	10.32±0.28
T4	8.92±0.55

Values are means ± SE.



Graph 4: Grain yield acre-1

Total Grain Yield

Harvesting and threshing was done on 140 DAS and the total grain yield scored in quintal acre^{-1} as presented in table 6 and graph 4. The significant maximum grain yield 10.32 quintal acre^{-1} was obtained for treatment T3 and the minimum (6.33 quintal acre^{-1}) for T0.

Discussion

A lot of similar study has been conducted time to time on different crop by many authors and proved that microbial biofertilizers are beneficial for crops growth and yield. The result obtained in this study indicated that the application of microbial biofertilizers will be helpful in the morphological growth and biological yield of mustard. Also it was obtained from the above study that the foliar application of Sulfur (applied in T3) plays a major role in the growth and yield in Mustard. From the above study, it can be concluded that the combination of organic fertilizer, microbial fertilizer along with intermediate application of sulfur is best to gate better growth and yield in Mustard.

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