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Effect of variable doses of organic manures on growth & yield of mustard (*Brassica juncea*) under Dehradun district of Uttarakhand

Ankur Sharma, Anil Kumar Saxena and Vijay Kumar Singh

Abstract
The present investigation "Effect of Variable Doses of Organic Manures on Growth & Yield of Mustard (*Brassica juncea*) Under Dehradun District of Uttarakhand" conducted during the Rabi season of 2021-2022 at Agricultural Research Farm of Shri Guru Ram Rai University, Dehradun, India. The experiment was laid out in randomize block design with three replications. The treatment T_1 (Control), T_2 (FYM 5t/ha), T_3 (FYM 5t/ha + Vermiwash @ 5%), T_4 (FYM 5t/ha + Cow Urine @ 5%), T_5 (Vermicompost 5t/ha + FYM 5t/ha + Vermiwash @ 5%), T_6 (Vermicompost 5t/ha), T_7 (Vermicompost 5t/ha+ Vermiwash @ 5%), T_8 (Vermicompost 5t/ha + Cow Urine @ 5%), T_9 (Vermicompost 5t/ha + FYM 5t/ha), T_{10} (FYM 5t/ha + Vermiwash @ 5% + Cow Urine @ 5%) and Mustard variety *i.e.*, BL-9. The experimental data shows that the treatment T_3 (FYM 5t/ha + Vermiwash @ 5%) found best yield. The variety BL-9 performs better with (FYM 5t/ha + Vermiwash @ 5%) respect to growth and yield parameters. Based on finding of research, it can be concluded that under prevalent climatic conditions of Dehradun region, the efficiency of organic manure to mustard crop was found to be towards profitable higher yield and benefits to the farmers.

Keywords: Farm yard mannure, yield, vermiwash, vermicompost, organic mannure

Introduction
Indian mustard (*Brassica juncea*) is an annual growing perennial herb and is one of the important oilseed crops that belongs to the family (Brassicaceae) Crucifereae. Indian mustard has 36 chromosomes (2n) and is amphidiploid in nature. Brassica crops is mostly cultivated for edible vegetable oil production. They have a long list of history owing to their cultivation and varied use and has a great contribution in world's agricultural economy. They are widely cultivated as spices as condiments throughout the world both for human consumption and also for livestock feedings. Commonly cultivated species of Indian mustard (Brown mustard) are *B. Juncea* ssp. Integrifolia, *B. Juncea* ssp. *Juncea*, *B. Juncea ssp. napiformis*, and *B. Juncea ssp. taisai.* India comes as the third largest country in mustard production after China and Canada. It secures unique position in Indian farming system with an impressive acreage next to food seeds. Despite the fact that nearly 33.8 per cent of the total cropped area in world (7.49 million ha) is under oil seeds, India is still facing a severe shortage of edible oils because the average productivity seed yield in India is about 697.9 kg per ha as against 917 kg per ha yield of the world. Edible oil industry body COOIT has estimated the country's mustard seeds production to rise 29 per cent to 109.50 lakh tonnes in the Rabi season of 2021-22 crop year. The output of mustard seeds, which is grown in Rabi (winter-sown) season, stood at 85 lakh tonnes in the previous year. Central Organisation for Oil Industry & Trade (COOIT) finalised the estimates of mustard seeds production during its 42nd annual conference, which was held at Bharatpur in Rajasthan on March 12-13. The use of organic manure (vermicompost) and supplementation of soil fertility through mineral nutrients is essential not only to harvest higher yields of crops but to maintain the physical, chemical and biological properties of the soil. Therefore, the present study was carried out with objective to study the effect of vermicompost and nutrients on soil properties, yield, uptake and quality of mustard. Cattle urine is a good source of nitrogen, phosphate, potassium, calcium, magnesium, chlorite and sulphate (Belie *et al*. 2000) [2]. Application of cow urine has also been reported to correct the micronutrient deficiency, besides improving the soil structure, and working as plant hormone. Therefore, it seems that cow urine under livestock based integrated farming system has a great potential for use as a bio- fertilizer to economize the crop production.

Vermiwash is coelomic fluid extraction contains several enzymes, plant growth hormones like cytokinins, gibberlines and vitamins along with mocro and macro nutrients (Buckerfield *et al*., 1999) [2]. In vermiwash nitrogen present in the form of mucus, nitrogenous excretory substances growth stimulating hormones and enzyme (Tripathi and Bhardwaj, 2004) [3]. Vermiwash bio-fertilizer was obtained from vermicomposting waste corn pulp blended with cow dung manure. The pH and electrical conductivity was higher in the vermicompost compared to the vermiwash. The nitrogen and potassium content were 57% and 79.6% higher in the vermicompost as compared to the vermiwash respectively. However, the phosphorous content was 84% higher in the vermiwash as compared to the vermicompost. The vermiwash was 89.1% and 97.6% richer in Ca and Mg as compared to the vermicompost. Furthermore, the vermiwash was 97.8% rich in sodium content compared to the vermicompost (Manyuchi *et al*., 2013) [4]. It increases the disease resistant power of crop, (Yadav *et al*., 2005) [5]. Varghese and Prabha (2014) [6] study suggests that, vermiwash revealed potential application in sustainable development in agriculture biotechnology with respect to its origin, cost effectiveness, availability, reproducibility, reliability as well as biopesticide and eco-friendly soil conditioner. Farm Yard Manure helps in increasing microbes' population and their activities, which play an important role in easily availability of complex nutrients to the plants. Farm yard manure (FYM) improves the soil physio-chemical properties along with direct release of macro as well as micronutrient; ultimately the crop yields increase (Lakkineni and Abrol, 1994) [7]. The long-term application of organic manures alone in the form of well-rotten and good quality farmyard manure (FYM) has been reported to make nutrients available gradually, in synchrony with plant needs. Besides improving the physicochemical properties of soil, the application of organic manures can also increase productivity while maintaining a better energy and environmental balance (Singh *et al*., 2014b) [8].

Materials and Methods

The trial was conducted in a randomized block design, under organic management that included three treatments, which are Farm yard manure, Vermicompost, Cow Urine & Vermiwash with Ten combinations of the treatments and three replications of each combination. The trial was carried out at Dehradun at the experimental farm of Shri Guru Ram Rai University, during crop year (27 October 2021 to March 2022). The BL-9 hybrid variety of Mustard was used. On the basis of gross plot size Farmyard Manure and Vermicompost were given at the time of sowing. The application of Cow Urine & Vermiwash at the time of vegetative growth of pants was done. A total of 30 blocks were made in the field for trial and the size of each block was 4m x 4m and each block had a total area of 24 m^2. Five rows were made in each block for sowing of Mustard. In each block row to row distance was 25cm. Canals were made around the field and in between the replication columns. Prepare the land to fine filth, form beds and channels. Seeds were used for sowing. Sowing of seeds was done during last week of October in the year 2021. The organic manures i.e. vermicompost, farm yard manure were applied at the time of field preparation. All the cultural practices were done at regular intervals as per the requirement of crop. During the experimental trial, from each replication, randomly selected five plants were used for recording various observations on growth and yield promoting parameters during the cropping period at 30, 60 & 90 days after sowing and at final harvest stage.

The experiment consisted of Ten treatments *viz*. T_1 Control T_2 FYM (Fram Yard Manure) 5 tn/ha,T_3 FYM 5 tn/ha + Vermiwash @ 5%,T_4 FYM 5 tn/ha + Cow urine @ 5%, T5 Vermicompost 5 tn/ha + FYM 5 tn/ha + vemiwash @ 5%, T_6 Vermicompost 5 tn/ha, T_7 Vermicompost 5tn/ha + vermiwash @ 5%, T_8 Vermicompost 5 tn/ha + Cow urine @ 5%, T_9 Vermicompost 5 tn/ha + FYM 5 tn/ha, T_{10} + FYM 5 tn/ha + vemiwash @ 5% + Cow Urine @ 5%. The experiment was laid out in randomized block design with three replications. The crop was sown on October 27, 2021 with a seed rate of 25 kg/ha. Row to row distance was kept at 45 cm and plant to plant was 22cm, the crop was harvested on February, 07, 2022.

Result and Discussion

Plant Height

Plant height of mustard increased with advancement of crop age and reached the maximum at harvest. The effect of all treatments on plant height was well pronounced at every successive growth stage (Table no. 1). At 90 days stage, T7 i.e., Vermicompost (5t/h) + Vermiwash @ (5%) recorded significantly lower plant height (132.217 cm) than other treatments. The maximum plant height (148.887 cm) was obtained under T_2. Which was followed in increasing order as T_4 (135.553 cm), T_5 (139.997cm), T_9 (140.997cm), T_{10} (141.107 cm), T_3 (144.440 cm) T_8 (145.550 cm) T_6 (147.773 cm) and T_1 (148.887 cm). Which shown in (fig. no.1). The results are in conformity with the findings of Premi *et al*. (2005).

Branches Per Plant

Organic Manures affected the number of branches significantly (Table no 1). At harvest, the maximum number of branches per plant was obtained under T3 and T8 (9.333) which was followed by T5 and T7 (9.000) T1, T6 and T10 (8.667). T2, T4 and T9 recorded minimum number of branches per plant (8.333). Which shown in (fig. no.1). The results are in close conformity with the findings of Singh and Singh (2005) and Dongrawar *et al*. (2007).

Number of Siliqua

The effect of Organic Manure on number of Number of siliqua per plant were observed at different growth stages of the plant (Table no. 2). At the time of harvest, the maximum number of siliqua per plant was obtained under T8 recorded the maximum number of siliqua per plant (137.000), followed by T_7 (134.000), T_9 (129.333), T_6 (123.33), T_1 & T_4 (122.667) and T_{10} (121.333), T_2 (120.667), T_3 (119.33) T_5 recorded the minimum number of siliqua per plant (110.667). Which shown in (fig No 2). The results are in close conformity with the findings of Dadheech *et al*. (2009) [11]

Number of Seeds per Siliqua

The number of seeds/siliqua was significantly influenced by the application of Different treatments organic Manure (Table no. 2). Control plots recorded the lowest number of seeds per siliqua T_1 (10.667), T_8 recorded significantly highest number of seeds per siliqua (17.667), which was significantly at par with T_4 (15.667) followed by T_7 (15.000), and T_3 (14.667), T_5 & T_{10} (14.333) and T6 (13.000), T_9 (12.667), T_2 (12.333) were

statically similar to each other's. Which shown in (fig. no.2). The results are in close conformity with the findings of Dadheech *et al.* (2009) [11].

Harvesting Index

The highest harvest index were gathered on the basis of grain yield and total biological yield. The non-significant differences were observed among the various weed control treatments for harvest index (Table no. 2). However, treatment T_3 had the highest harvest index value (36.77%) followed by T_6 (31.03%), T_2 (30.51%), T_4 (29.30%), T_5 (28.65%), T_{10} (28.48%), T_1 (25.27%), T_7 (23.80%), T_9 (21.92%) T_8. While the lowest harvest index was registered under T_8 (21.40%). Which shown in (fig. no.4). The results are in conformity with the findings of Present investigation is in close conformity with the findings of Abraham *et al*. (2008) [1] and Maheshbabu *et al*. (2008) [7].

Highest Gross Return

The highest gross return was influence of different treatments on gross return (Rs/ha) was well marked (Table no. 2). The maximum gross return (Rs 194,636.6) was obtained under treatment T_3 followed by, T_2 (Rs 163,971.4), T6 (Rs 160,040.6), T_7 (Rs 147,826.6), T_{10} (Rs 143,635.4), T_4 (Rs 142,333.4), T_5 (140,634.6), T_8 (Rs 134,459.4), T_1 (Rs 110,465.4) and least gross return is (Rs 106,950) was obtained under treatment T_9 Which shown in (fig. no. 3). All treatments recorded significantly higher net return over T_9. Treatment T_3 although generated the highest net return (Rs 161,649.8), followed by T_2 (Rs 132,912.4), T_6 (Rs 114,523.1), T_4 (Rs 109,346.6), T_7 (Rs 100,381.3), T_{10} (Rs 94,583.6), T_5 (Rs 91,582.8), T_8 (87,014.1), T_1 (Rs 81,040.4). Treatment T_9 recorded lowest net return (Rs 59,826). All treatments significantly influenced the benefit-cost ratio. Maximum benefit-cost ratio was obtained with the treatment T_3 (4.9), which is par with T_2 (4.2), followed by T_4 (3.31), par with all the other treatments T1 (2.75), T_6 (2.51), T_7 (2.11), T_{10} (1.92), T_5 (1.86), T_8 (1.83) and minimum is T_9 (1.26). Which shown in (fig. no. 5). The results are in close conformity with the findings of (Singh and Pal, 2011) & (Singh *et al.*, 2017).

Table 1: Effect of variable doses of organic manures on growth height & branches.

S. No	Treatments	Days After Sowing Height			Days After Sowing Branches		
		30 DAS	60 DAS	90 DAS	60 DAS	90 DAS	At Harvesting
T_1	Control	28.110	106.660	148.887	3.333	6.667	8.667
T_2	FYM 5tn/ha	28.663	87.773	148.887	2.667	6.333	8.333
T_3	FYM 5tn/ha + Vermiwash @ (5%)	28.997	98.887	144.440	2.667	6.333	9.333
T_4	FYM 5tn/ha + Cow Urine @ (5%)	25.217	114.443	135.553	3.000	6.333	8.333
T_5	Vermicompost @ (5%) + FYM 5tn/ha + Vermiwash @ (5%)	28.330	99.997	139.997	3.333	7.000	9.000
T_6	Vermicompost	26.997	104.440	147.773	2.667	6.667	8.667
T_7	Vermicompost + Vermiwash @ (5%)	29.887	99.993	132.217	2.667	7.000	9.000
T_8	Vermicompost + Cow urine	29.883	105.553	145.550	4.000	7.000	9.333
T_9	Vermicompost + FYM 5tn/ha	30.107	92.220	140.997	2.333	6.000	8.333
T_{10}	FYM 5tn/ha + Vermicompost + Cow urine	28.553	94.440	141.107	2.667	6.667	8.667
SEm±		1.514	5.694	9.024	0.312	0.417	0.525
CD (P = 0.05)		N/A	N/A	N/A	0.935	N/A	N/A

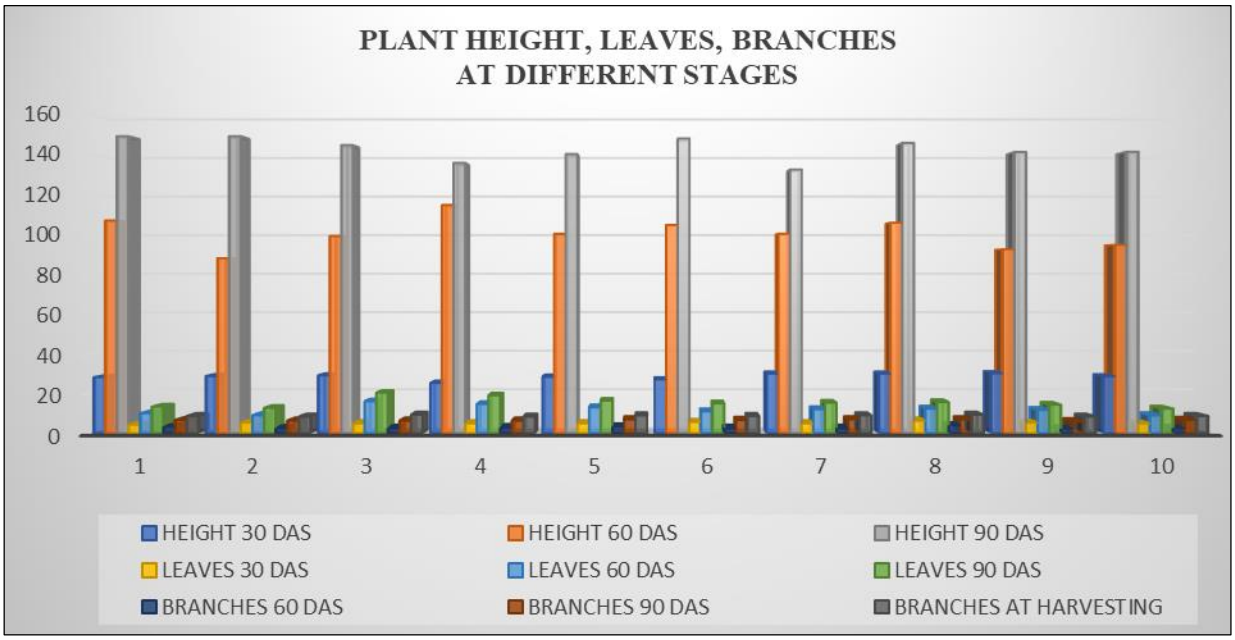

Fig 1: Plant height and branches at different stages

Table 2: Effect of variable doses of organic manures on no. of siliqua, & production cost.

S. No.	Treatments	Number of siliqua per Plant	Number of Seeds per siliqua	Gross return	Net return	B:C ratio	H.I (%)
T_1	Control	122.667	10.667	110,465.4	81,040.4	2.75	25.27
T_2	FYM 5tn/ha	120.667	12.333	163,971.4	132,912.4	4.2	30.51
T_3	FYM 5tn/ha + Vermiwash @ (5%)	119.333	14.667	194,636.6	161,649.8	4.9	36.78
T_4	FYM 5tn/ha + Cow Urine @ (5%)	122.667	15.667	142,333.4	109,346.6	3.31	29.30
T_5	Vermicompost @ (5%) + FYM 5tn/ha + Vermiwash @ (5%)	110.667	14.333	140,634.6	91,582.8	1.86	28.65
T_6	Vermicompost	123.333	13.000	160,040.6	114,523.1	2.51	31.03
T_7	Vermicompost + Vermiwash @ (5%)	134.000	15.000	147,826.6	100,381.3	2.11	23.80
T_8	Vermicompost + Cow urine	137.000	17.667	134,459.4	87,014.1	1.83	21.40
T_9	Vermicompost + FYM 5tn/ha	129.333	12.667	106,950	59,826	1.26	21.92
T_{10}	FYM 5tn/ha + Vermicompost + Cow urine	121.333	14.333	143,635.4	94,583.6	1.92	28.48
S.E.M±		4.324	1.265	-	-	-	NA
CD (P = 0.05)		13.000	NA	-	-	-	NA

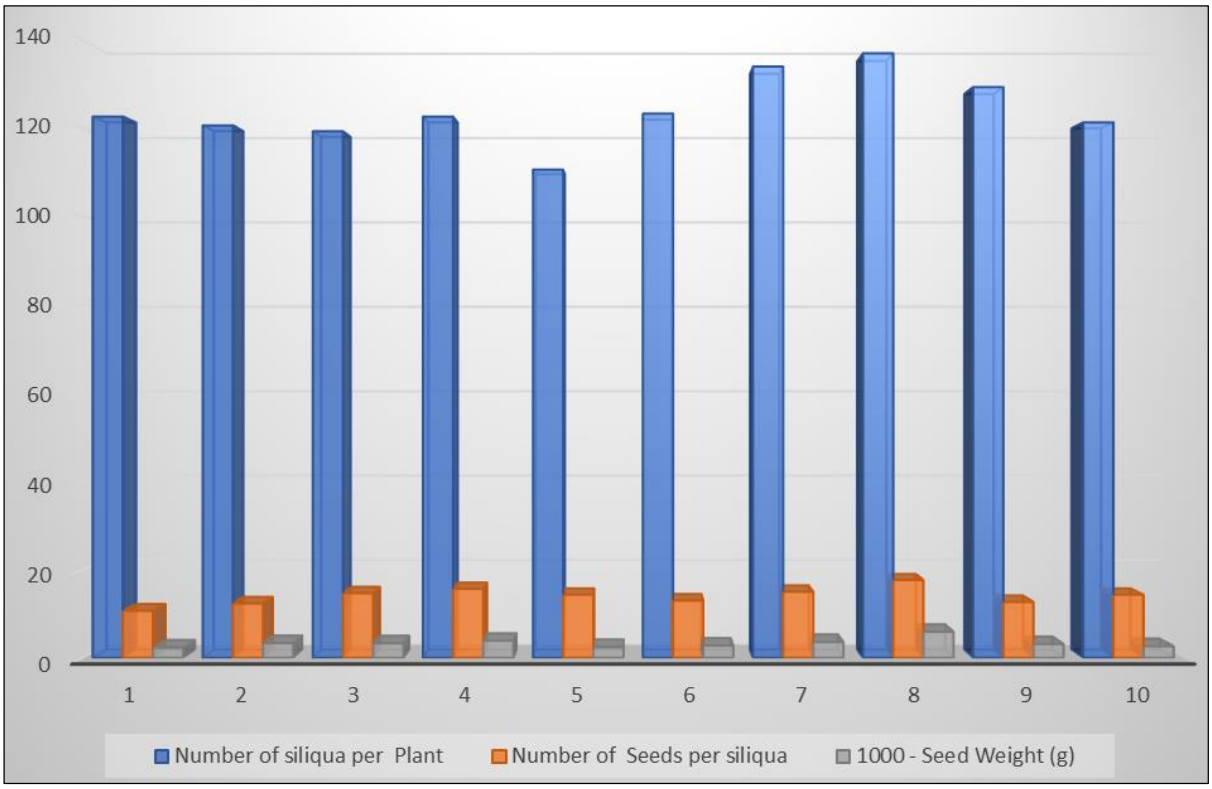

Fig 2: No. of Siliqua/plant & no. of seeds/siliqua

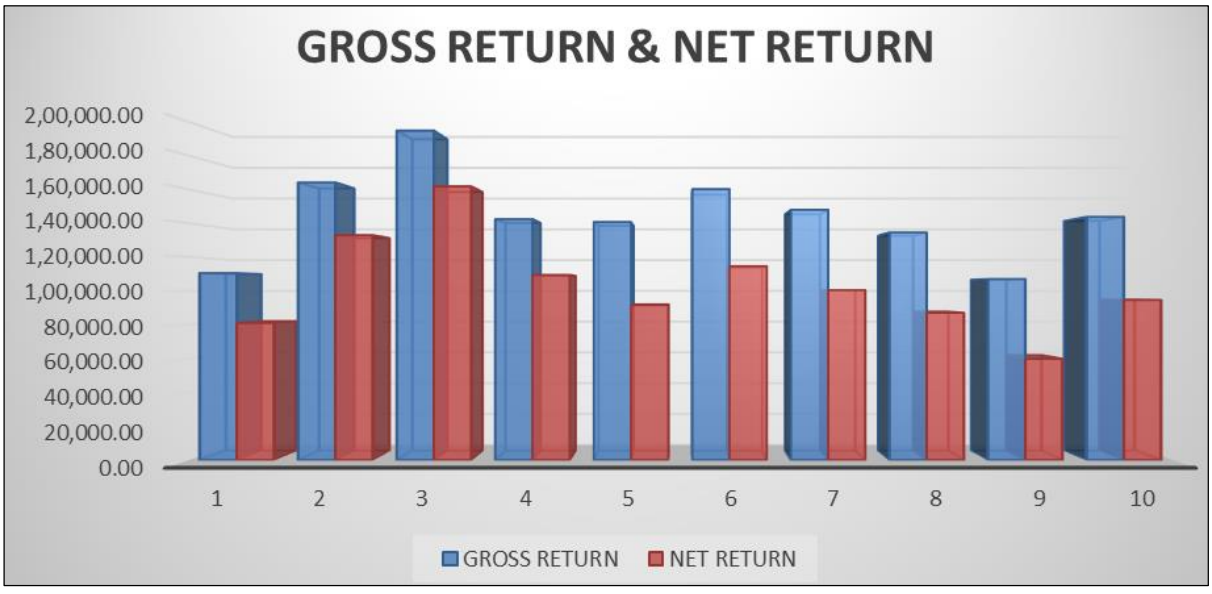

Fig 3: Gross return & Net return

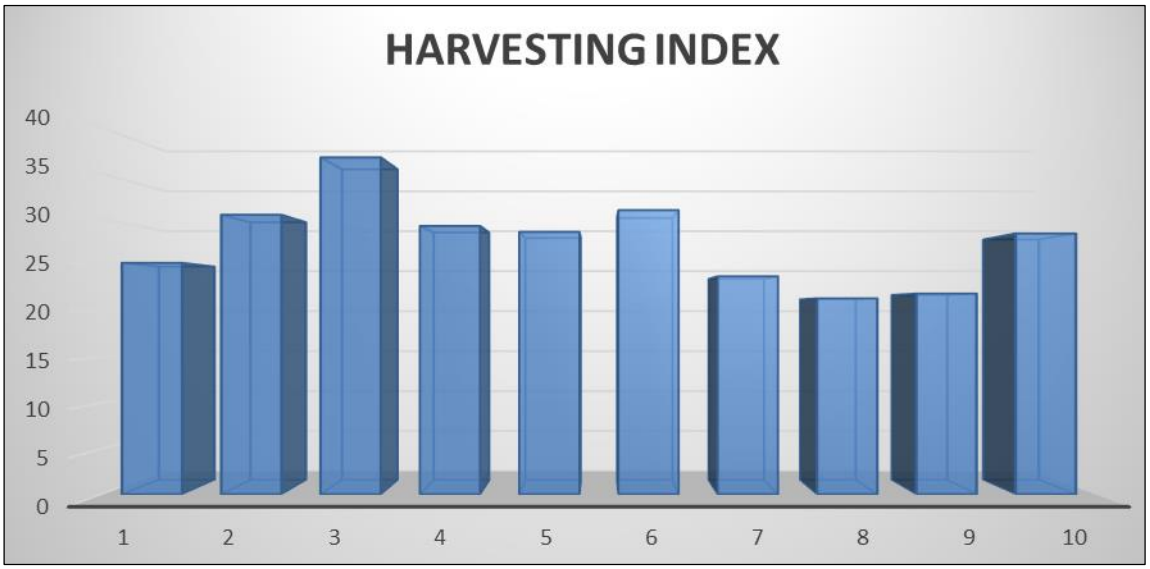

Fig 4: Harvesting index

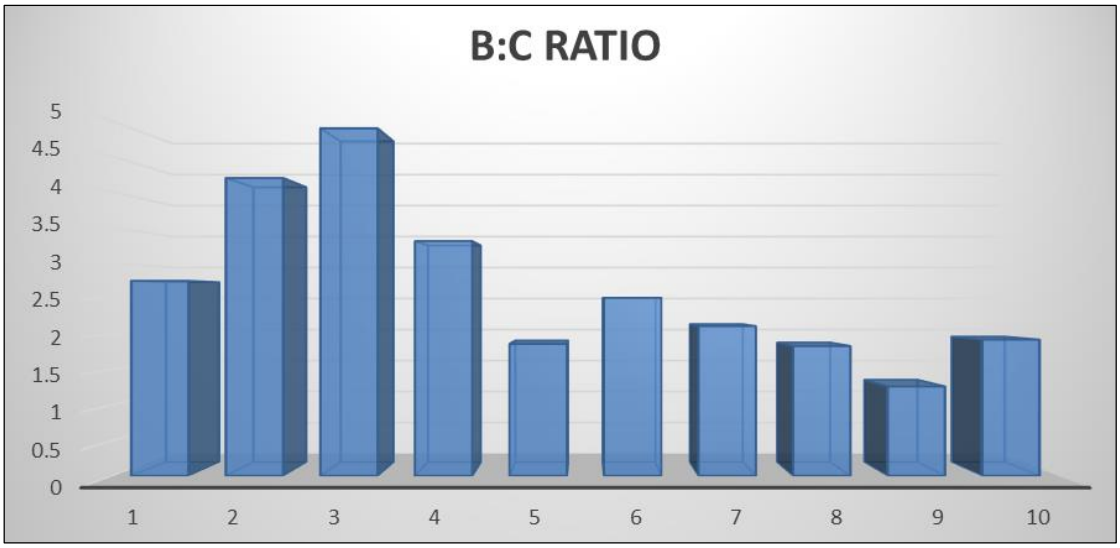

Fig 5: B:C Ratio

Conclusion

Thus, Based on the finding of experiment it could be concluded that application of variable doses of organic manures alone or in combination with treatment @ T_3 (FYM 5t/ha + Vermiwash @ 5%) has perform better other treatment in terms of growth, yield attributes & net return. Long term experimentation is required to validate this result. New combination of intercrop could be tested for site specific technology. Different sources of solid or liquid manures may have different effect; therefore, trails for this comparison can be plan considering local condition, farming system, soil and climatic condition.

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