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Effect of different levels of organic fertilizers and inorganic Fertilizers on growth and yield of barely (*Hordeum vulgare*) under Poplar (*Populus deltoids*) based agroforestry system

Harshita Singh, Sameer Daniel, Puja Kishore and Priyanka Ekka

Abstract

A field experiment which was carried out in the nursery of College of Forestry, SHUATS, Prayagraj 2019-2020 to evaluate effect of the different levels of Organic and Inorganic fertilizers on growth and yield of Barely (*hordiumvulgare*) under poplar based agroforestry system. Field was prepared, plot was divided into 33 blocks and 11 treatments were given and replication of each treatment was three, then seeds of Barley were line sown and mild irrigation was given to field. There were eleven treatments viz., T₀ (controlled); T₁ (recommended doses of NPK); T₂ (compost); T₃ (FYM); T₄ (Vermicompost), T₅ (Vermicompost 50% + Compost 50%), T₆ (Vermivompost50% + FYM50%), T₇ (Vermicompost 33% + Compost 33% + FYM33%), T₈ (Vermicompost50% + Recommended NPK), T₉ (Compost50%+ Recommended NPK), T₁₀ (FYM 50% + Recommended NPK). Experiment was laid out in the Randomized Block Design (RBD) with three replications. The study also revealed that application of T₈ (NPK 50% + Vermicompost 50%) was found to be the best treatment for obtaining the maximum plant height (95.66 cm), no. of tillers hill⁻¹ (11.20), length of spike (16.32 cm),no. of grains spike⁻¹ (55.63) test weight (47.16g), grain yield (37.80 q ha⁻¹) and straw yield (47.63 q ha⁻¹) of Barley. As for the economic yield of barley cultivation study revealed that the results application of T₉ (NPK50% +Compost50%) was found to be the best treatment for obtaining benefit cost ratio (1: 2.08) of Barley.

Keywords: Organic fertilizers, inorganic fertilizers, barley, poplar

1. Introduction

Poplar based agroforestry systems provide about Rs. 70,000-80,000 per year per acre which is approximately three times more than the rice-wheat rotation in central plains of Punjab. This has boosted the economy and improved the livelihood pattern of the poplar growers, and helped in the development of plywood industry in the state [3]. This poplar based agroforestry system is economically more viable and profitable livelihood option than many of the crop rotations. It is also capable of providing continuous employment on farms and preserving ecological system as well [1]. In India Barley is being grown in three distinct type of soil groups mainly Sandy Loam, Loam and Medium & Heavy Black Soils. Sandy to moderately heavy loam soils of Indo-Gangetic plains having neutral to saline reaction and medium fertility are the most suitable type for barley cultivation. In India Barley is being grown in three distinct types of soil groups mainly Sandy Loam, Loam and Medium & Heavy Black Soils [8]. Sandy to moderately heavy loam soils of Indo-Gangetic plains having neutral to saline reaction and medium fertility are the most suitable type for barley cultivation. However, it may be grown on variety of soil types, viz, saline, sodic and lighter soils. Acidic soils are not fit for barley cultivation. Barley is mainly grown in Madhya Pradesh, Uttar Pradesh, Rajasthan, Bihar, Gujrat, Maharashtra. Barley grains are mainly used for animal feed and in the production of malt. Barley has high nutritive value which enhances milk production in dairy cattle's under agrosilvopastoral system [2]. Barley may be grown in subtropical climatic condition. The crop requires around 12-15 C during growing period and around 30 C at maturity. It cannot tolerate frost at any stage of growth and incidence of frost at flowering at highly detrimental.

Materials and Methods

The present study was comprised of a field experiment which was carried out in the nursery of College of Forestry SHUATS, Prayagraj 2019-2020 during period from November, 2019 to

February, 2020 with K-508 variety of barley under poplar based agroforestry model. The eleven treatments are given as follows T₀ (controlled); T₁ (recommended doses of NPK; T₂ (compost); T₃ (FYM); T₄ (Vermicompost), T₅ (Vermicompost50% + Compost50%), T₆ (Vermicompost 50% + FYM50%), T₇ (Vermicompost 33% + Compost 33% + FYM33%), T₈ (Vermicompost 50% + Recommended NPK), T₉ (Compost 50%+ Recommended NPK), T₁₀ (FYM 50% + Recommended NPK). The experiment research site is situated at an elevation of 98 meters above sea level at 25° 27 North latitude and 81° 51 E longitudes. From the analysis, it is evident that the soil of the experimental field was Sandy loam in texture, medium available in phosphorus and comparatively medium in nitrogen and potash, with normal pH 7. The experiment was arranged in Randomized Block Design with three replications, each replicated field was divided into nine treatments with each plot size is 4m². Pre sowing soil samples up to 30 cm depth were collected and analyzed for their physico-chemical properties such as Organic carbon (%) [19], total nitrogen (kg/ha.) by Alkaline permanganate method, phosphorus (kg/ha.) by Olsen's Calorimetric Method [4], and potassium (kg/ha.) by Flame Photometric Method [18]. Soil pH and EC measured by Digital pH meter and conductivity meter respectively [9]. The requisite agronomic and plant protection measures were adopted uniformly for all the treatments during the entire growing period. At maturity, data on plant characters and yield components were recorded from five randomly selected plants in each plot. The growth and yield characters were recorded such as plant height at harvest (cm), number of total tillers plant⁻¹, spike length (cm), number of spikelets spike⁻¹, number of grains spike⁻¹, 1000-seed weight (g), grain yield (t ha⁻¹), straw yield (t ha⁻¹), and harvest index(%). The crop from each unit plot was harvested at full maturity to record the data on grain and straw yields. The data was analyzed statistically.

Result and Discussion

The effect of different levels of organic fertilizers and inorganic fertilizers on barley (*Hordeum vulgare*) is presented in Table 1. Result showed in that plant height increased progressively in line sowing. The maximum plant height (95.66 cm), no. of tillers hill⁻¹(11.20), length of spike (16.32 cm), no. of grains spike⁻¹ (55.63) test weight (47.16g), grain yield (37.80 q ha⁻¹) and straw yield (47.63 q ha⁻¹) of Barley. As for the economic yield of barley cultivation study revealed that the results application of T₉ (NPK50% + Compost50%) [18, 13] was found to be the best treatment for obtaining benefit cost ratio (1:2.08) of Barley. There was significant difference between the treatments and maximum plant height (95.663cm) was observed the applications of T₈ (Vermicompost 50%+NPK 50%) which is at par with T₉ and

T₁₀ followed by T₁ (89.467cm) followed which is followed by T₂(85.740cm) which is at par with T₂ and T₄, whereas the lowest value (70.557cm) was observed in treatment T₀ Control [5]. There was significant difference between the treatments and maximum no. of tillers hill⁻¹ (11.20) was observed by the applications of T₈ (Vermicompost 50%+NPK 50%) which is at par with T₉ and T₁₀ followed by T₁(9.150) followed which is followed by T₂ (8.217) [6] which is at par with T₂ and T₄, whereas the lowest value (6.133cm) was observed in treatment T₀ Control. At 90 DAS, there was significant difference between the treatments and maximum length of spike (16.32) was observed by the applications of T₈ (Vermicompost 50%+NPK 50%) which is at par with T₉ and T₁₀ followed by T₁(13.50) followed which is followed by T₂ (12.82) [10] which is at par with T₂ and T₄, whereas the lowest value (8.7cm) was observed in treatment T₀ Control. The observation showed that at number of grains spike⁻¹ showed significant difference between treatments. There was significant difference between the treatments and maximum number of grains spike⁻¹ (55.633) [14] was observed the applications of T₈ (Vermicompost 50%+NPK 50%) [12] which is at par with T₉ and T₁₀ followed by T₁ (51.627) followed which is followed by T₇ (49.783) which is at par with T₂ and T₄, whereas the lowest value (42.617) was observed in in treatment T₀ Control. The observation showed that at test weight (g) there was significant difference between treatments. There was significant difference between the treatments and maximum and test weight (47.167g) [17] was observed the applications of T₈ (Vermicompost 50%+NPK 50%) which is at par with T₉ and T₁₀ followed by T₁ (42.45g) followed which is followed by T₅ (39.747g) which is at par with T₂ and T₄, whereas the lowest value (32.367g) was observed in treatment T₀ Control. There was significant difference between the treatments and maximum grain yield (37.80q⁻¹ha) [7, 11] was observed the applications of T₈ (Vermicompost 50%+NPK 50%) which is at par with T₉ and T₁₀ followed by T₁(32.32q⁻¹ha) followed which is followed by T₇ (29.813q⁻¹ha) which is at par with T₂ and T₄, whereas the lowest value (23.500 q⁻¹ha) was observed in treatment T₀ Control. There was significant difference between the treatments and maximum Straw yield (q ha⁻¹) (47.633q⁻¹ha) [14] was observed the applications of T₈ (Vermicompost 50%+NPK 50%) which is at par with T₉ and T₁₀ followed by T₁ (43.700q⁻¹ha) followed which is followed by T₄ (40.317q⁻¹ha) which is at par with T₂ and T₆, whereas the lowest value (35.233q⁻¹ha) was observed in in treatment T₀ Control. There was significant difference between the treatments and maximum harvest index (44.38) [16] was observed the applications of T₉ which is at par with T₁₀ and T₈ followed by T₇ (42.76) which is at par with T₇ and T₆, whereas the lowest value (40.01) was observed in treatment T₀ Control.

Table 1: Growth attributes of Yield attributes of Effect of different organic manures and inorganic fertilizer on barley (*Hordeum vulgare*) under poplar (*Populus deltoids*) based Agroforestry system

Treatments	Plant Height (cm)	No. of tiller/ hill	Length of spike (cm)	No. of grain/spike
T ₀	70.557	6.133	8.700	42.617
T ₁	89.467	9.150	13.500	51.627
T ₂	85.690	8.217	12.823	48.550
T ₃	84.490	7.813	12.560	48.420
T ₄	85.583	8.100	12.623	48.757
T ₅	84.367	7.800	12.500	49.733
T ₆	84.400	7.910	12.517	48.500
T ₇	85.740	7.950	12.697	49.783
T ₈	95.663	11.200	16.320	55.633
T ₉	93.520	10.800	15.717	54.850

T ₁₀	93.483	10.500	15.733	54.800
C.D. at 0.5%	0.439	0.292	0.381	0.393
S.Ed. (+)	0.209	0.139	0.181	0.187

Table 2: Yield attributes of Effect of different organic manures and inorganic fertilizer on barley (*Hordeum vulgare*) under poplar (*Populus deltoids*) based Agroforestry system

Treatments	Test weight (1000 grain weight) g	Grain yield (q/ha)	Straw yield (q/ha)	Harvest Index (%)
T ₀	32.367	23.500	35.233	40.01
T ₁	42.450	32.327	43.700	42.51
T ₂	39.160	28.373	40.300	41.31
T ₃	39.450	28.600	39.967	41.71
T ₄	39.700	28.923	40.317	41.77
T ₅	39.747	29.267	40.183	42.13
T ₆	38.990	29.473	40.033	42.40
T ₇	38.997	29.813	39.900	42.76
T ₈	47.167	37.800	47.633	44.24
T ₉	45.667	36.417	45.633	44.38
T ₁₀	45.400	36.050	45.900	43.99
C.D. at 0.5%	0.874	0.439	0.464	0.464
S.Ed. (+)	0.416	0.209	0.221	0.221

Conclusion

From the study it may be concluded that treatment of T₈ (NPK50% + Vermicompost 50%) was found to be the best treatment for obtaining higher growth parameters of Barley. The study also revealed the results that application of T₈ (NPK50%+ Vermicompost 50%) was found to be the best treatment for obtaining higher test weight (47.16g), grain yield (37.80 q ha⁻¹) and straw yield (47.63 q ha⁻¹) of Barley and for the economic yield of barley cultivation study revealed that the results application of T₉ (NPK50%+Compost 50%) was found to be the best treatment for obtaining benefit cost ratio (1: 2.08) of Barley.

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