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Effect of Nutrient Combination on Growth and Yield Attributes of Barley in Late Sowing Condition

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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

A field experiment was conducted at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan) during Rabi season of 2022-23 to Effect of nutrient combination on growth and yield attributes of barley in late sowing condition. Barley variety „ RD-2035" was used in this study. The experiment was laid out in randomized block design with three replications consisting of ten treatments combinations i.e. T1-Control, T2-100% RDF, T3-75% RDF + 2t FYM + 10 kg Zn, T4- 50% RDF + 4t FYM + 20 kg Zn, T5-75% RDF + 1.5t Vermicompost, T6-50% RDF + 3t
Vermicompost, T7-75% RDF + 1t Poultry manure, T8-50% RDF + 2t Poultry manure, T9-75% RDF + 1.5t Compost and T10-50% RDF + 3t Compost. The increased growth parameter such as as plant height (cm), total number of tillers, leaf area index and dry matter accumulation with the application of 75% RDF + 1t Poultry manure. The application of 75% RDF + 1t Poultry manure increased all the yield parameters as compared to control.

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1. INTRODUCTION

"Barley (*Hordeum vulgare* L.) is the world's fourth most important cereal crop after wheat, rice and maize. It is grown practically everywhere in the globe because it is the most dependable crop in regions that have alkali, frost, or drought. China, Russia, Germany, the United States, Canada, India, Turkey, and Australia are the top exporters of barley. Barley grain is primarily used in the brewing industry to produce malt, which is then used to generate beer, industrial alcohol, whisky, malt syrups, brandy, malted milk, vinegar, and yeast. Each 100 gm of barley grain comprise 10.6 g protein, 2.1 g fat, 64 g carbohydrates, 50 mg calcium, 3 g crude fibre, 6 mg iron, 31 mg vitamin B_1, 0.10 mg vitamin B2 and 50 µg folate" [1]. "Barley is superior to wheat in some minerals and fiber contents and also contains water soluble fiber and oil compound which are found to be effective in lowering cholesterol level of blood. Barley is grown on 757 thousand hectares area with 2045 thousand tones production and average yield of 2663 kg ha^{-1} and it is largely confined to North-West region" (India stat, 2021-22).

"Barley requires considerable amounts of major nutrients, particularly nitrogen (N) and phosphorus (P) for harnessing potential yield. Adequate mineral fertilization is considered to be one of the most important pre-requisites in this respect. Despite the application of recommended quantities of major nutrients, the increase in yield is not encouraging. In nutrient management, organic manures are potential sources of micro-nutrients, which improve soil structure by providing binding action to soil aggregates, water-holding and buffering capacity of soils. The FYMsupplies all major nutrients (N, P, K, Ca, Mg, S,) necessary for plant growth, as well as micronutrients (Fe, Mn, Cu and Zn). Hence, it acts as a mixed fertilizer. The FYM improves soil physical, chemical and biological properties and soil water-holding capacity. Nitrogen management plays a key role in improving crop yield and quality, environmental safety and economics of based on their crop production. Concluded that not only increasing N fertilization rate but also N timing had a beneficial effect on grain yield and its quality. Nitrogen fertilizer rate and timing are the major tools available after planting for manipulating wheat growth and development to produce a greater grain yield per unit area" [2].

"In recent years due to unsuitable effect of chemical fertilizers on the soil, using of organic materials serves as a good and suitable source to supply soil food elements. In addition to supply nutrients, organic manures may improve the soil health, physicochemical properties and biological conditions of the soil. Application of organic manures may improve availability of native nutrients in soil as well as the efficiency of applied fertilizers" [3]. "Judicious use of FYM with chemical fertilizers improves soil physical, chemical and biological properties and improves the crop productivity" [4]. To build ecologically sound and economically viable farming systems integrated nutrient management (INM) is a viable option for wheat production as it utilizes available organic and inorganic nutrients. Keeping this in view of above facts, an attempt was made to study the effect of integrated nutrient management on growth, yield attributes and yield of wheat.

2. MATERIALS AND METHODS

A field experiment was conducted during Rabi season of 2022-23 at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam in texture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.16%), deficient in available zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) and phosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment was laid out in randomized block design with three replications consisting of ten treatments combinations i.e. T_1-Control, T_2-100% RDF, T_3-75% RDF + 2t FYM + 10 kg Zn, T_4-50% RDF + 4t FYM + 20 kg Zn, T_5-75% RDF + 1.5t Vermicompost, T_6-50% RDF + 3t Vermicompost, T_7-75% RDF + 1t Poultry manure, T_8-50% RDF + 2t Poultry manure, T_9-75% RDF + 1.5t Compost and T_{10}-50% RDF + 3t Compost. Seed rate 100 Kg of Barley variety „ RD-2035" was used in this study. the half dose of urea, DAP and potash were basally applied in plots according to the treatment assigned in each plot before sowing, and next dose of urea, DAP and potash given at the first irrigation.

3. RESULTS AND DISCUSSION

The purpose of this study was to determine the extent of performance for several growth and yield traits. This Growth parameters include in

present study such as plant height (cm), total number of tillers, leaf area index and dry matter accumulation and yield traits viz., spike length, number of grains/spike,test weight, gain yield,straw yield, biological yield and harvest index(%) of Barley.

3.1 Growth Attributes

The highest plant height was recorded at 30 DAS with the treatment T_7-75% RDF + 1t Poultry manure (30.56 cm). The lowest plant height was recorded with the treatment T_1-Control (21.36 cm). The highest plant height was recorded at 60 DAS with the treatment T_7-75% RDF + 1t Poultry manure (72.85 cm). The lowest plant height was recorded with the treatment T_1-Control (54.35 cm). The highest plant height was recorded at 90 DAS with the treatment T_7-75% RDF + 1t Poultry manure (95.36 cm). The lowest plant height was recorded with the treatment T_1-Control (74.36 cm). The highest plant height was recorded at harvest stage with the treatment T_7-75% RDF + 1t Poultry manure (96.78 cm). The lowest plant height was recorded with the treatment T_1-Control (78.36 cm). Similar findings were also found by Paretaet *al.* [5] Gaur *et al.* [6] Meenaet *al.* (2017). The enhancement in plant height with increase dose of organic manure is attributed to the rapid conversion of synthesized carbohydrates into protein and consequent to increase in the number and size of growing cells, resulting ultimately in increased plant height of wheat. These results are supported by the findings of Sepatet *al.* [7] who reported that the use of organic manures in combination with mineral fertilizers maximized the plant growth.

The highest dry matter accumulation was recorded at 30 DAS with the treatment T_7-75% RDF + 1t Poultry manure (42.36 g/m^2). The lowest dry matter accumulation was recorded with the treatment T_1-Control (22.36 g/m^2). The highest dry matter accumulation was recorded at 60 DAS with the treatment T_7-75% RDF + 1t Poultry manure (235.65 g/m^2). The lowest dry matter accumulation was recorded with the treatment T_1-Control (138.36 g/m^2). The highest dry matter accumulation was recorded at 90 DAS with the treatment T_7-75% RDF + 1t Poultry manure (655.45 g/m^2). The lowest dry matter accumulation was recorded with the treatment T_1-Control (565.36 g/m^2). The highest dry matter accumulation was recorded at harvest stage with the treatment T_7-75% RDF + 1t Poultry manure (885.32 g/m^2). The lowest minimum dry matter accumulation was recorded with the treatment T_1-Control (725.36 g/m^2). Similar results were observed by Gaur *et al.* [6] Kumawat *et al.* [8] Meena *et al.* (2017).

The maximum total number of tillers was recorded at 30 DAS with the treatment T_7-75% RDF + 1t Poultry manure (69.45). The minimum total number of tillers was recorded with the treatment T_1-Control (55.36).The maximum total number of tillers was recorded at 60 DAS with the treatment T_7-75% RDF + 1t Poultry manure (80.45). The minimum total number of tillers was recorded with the treatment T_1-Control (61.54).The maximum total number of tillers was recorded at 90 DAS with the treatment T_7-75% RDF + 1t Poultry manure (93.45). The minimum total number of tillers was recorded with the treatment T_1-Control (67.56).The maximum total number of tillers was recorded at harvest stage with the treatment T_7-75% RDF + 1t Poultry manure (91.45). The minimum total number of tillers was recorded with the treatment T_1-Control (69.52).The maximum leaf area index was recorded with the treatment T_7-75% RDF + 1t Poultry manure (3.08). The minimum leaf area index was recorded with the treatment T_1-Control (1.61).Findings of Rao, [9] Kumawat*et al.* [8] Meena *et al.* (2017) supported such results.

3.2 Yield Attribute

The maximum spike length was recorded with the treatment T_7-75% RDF + 1t Poultry manure (7.69 cm). The minimum spike length was recorded with the treatment T_1-Control (5.69 cm).The maximum number of grains/spike was recorded with the treatment T_7-75% RDF + 1t Poultry manure (46.69). The minimum number of grains/spike was recorded with the treatment T_1-Control (29.45). Similar results were observed by Chestie*t al.,* (2013) Meena*et al.* (2017), and Shantveerayya*et al.,* [10].Jat et el. [11]. The maximum number of grain yield was recorded with the treatment T_7-75% RDF + 1t Poultry manure (45.36 q/ha). The minimum grain yield was recorded with T_1-Control (23.14 q/ha).The maximum number of strawyieldwas recorded with the treatment T_7-75% RDF + 1t Poultry manure (75.36 q/ha). The minimum strawyield was recorded with T_1-Control (48.78 q/ha).The maximum number of biologicalyieldwas recorded with the treatment T_7-75% RDF + 1t Poultry manure (120.72 q/ha). The minimum biologicalyield was recorded with T_1-Control (71.92 q/ha). Similar findings were also found by Paretaet *al.* (2009), Gaur *et al.* [6] Meena *et al.* (2017), Shantveerayya*et al.,* [10] Singh *et al.* (2020), Jat *et al*. [11,12,13].

Table 1. Effect of different nutrient combination on barley at different growth stages

Treatments	Plant height (cm)				Dry matter accumulation (g/m^2)				Total number of tillers (row/m^2)				Leaf area index
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest	
T_1-Control	21.36	54.35	74.36	78.36	22.36	138.36	565.36	725.36	55.36	61.54	67.56	69.52	1.61
T_2-100% RDF	28.45	68.89	92.48	93.78	38.63	225.99	640.78	802.14	65.23	76.58	89.56	87.56	2.75
T_3-75% RDF + 2t FYM + 10 kg Zn	25.36	64.89	88.78	90.45	34.69	210.15	612.58	800.54	61.22	72.23	85.02	83.15	2.6
T_4-50% RDF + 4t FYM + 20 kg Zn	24.36	62.36	85.44	88.85	32.66	198.36	600.45	785.36	60.36	70.25	83.65	81.45	2.57
T_5-75% RDF + 1.5t Vermicompost	29.36	70.48	93.86	95.48	40.45	233.69	645.96	845.12	68.45	78.45	91.78	89.48	2.95
T_6-50% RDF + 3t Vermicompost	23.95	58.96	81.65	85.78	26.45	175.36	585.36	768.88	58.12	68.96	80.36	78.33	2.68
T_7-75% RDF + 1t Poultry manure	30.56	72.85	95.36	96.78	42.36	235.65	655.45	885.32	69.45	80.45	93.45	91.45	3.08
T_8-50% RDF + 2t Poultry manure	24.05	60.36	83.56	86.98	28.03	192.78	588.45	775.12	59.66	69.45	81.55	79.36	2.52
T_9-75% RDF + 1.5t Compost	26.45	66.85	90.47	91.48	36.45	215.36	625.55	830.25	62.36	74.66	87.89	85.25	2.65
T_{10}-50% RDF + 3t Compost	23.5	57.89	79.36	84.66	25.36	165.36	580.45	750.36	57.36	68.45	78.16	77.66	2.48
SEm ±	0.36	0.75	0.95	1.15	0.72	8.25	10.12	22.25	1.45	2.22	2.78	2.98	0.11
CD at 5 %	1.09	2.26	2.85	3.44	2.15	24.75	30.35	66.75	4.35	6.65	8.34	8.95	0.33
CV%	8.65	7.25	9.35	9.12	8.35	8.96	9.95	7.25	8.22	9.36	10.14	7.25	8.78

Table 2. Effect of different nutrient combination on yield attributes and yield of barley

Treatments	Spike length (cm)	Number of grains/spike	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
T_1 : Control	5.69	29.45	34.36	23.14	48.78	71.92	32.17
T_2	7.34	42.44	43.36	42.58	68.96	111.54	38.17
T3	6.98	39.41	40.36	38.63	65.55	104.18	37.08
T4	6.85	37.88	38.35	36.45	63.45	99.9	36.49
T5	7.45	44.36	45.36	43.69	70.36	114.05	38.31
T6	6.58	34.69	36.45	33.69	60.45	94.14	35.79
T7	7.69	46.69	44.96	45.36	75.36	120.72	37.57
T8	6.78	36.54	37.36	34.69	62.45	97.14	35.71
T9	7.12	40.12	42.63	40.63	66.45	107.08	37.94
T10	6.45	33.63	35.36	32.14	58.56	90.70	35.44
SE.m.±	0.12	1.45	0.71	2.75	3.45	4.66	1.95
CD	0.36	4.35	NS	8.25	10.35	13.98	NS
CV	9.66	7.25	8.02	8.12	8.00	7.33	9.33

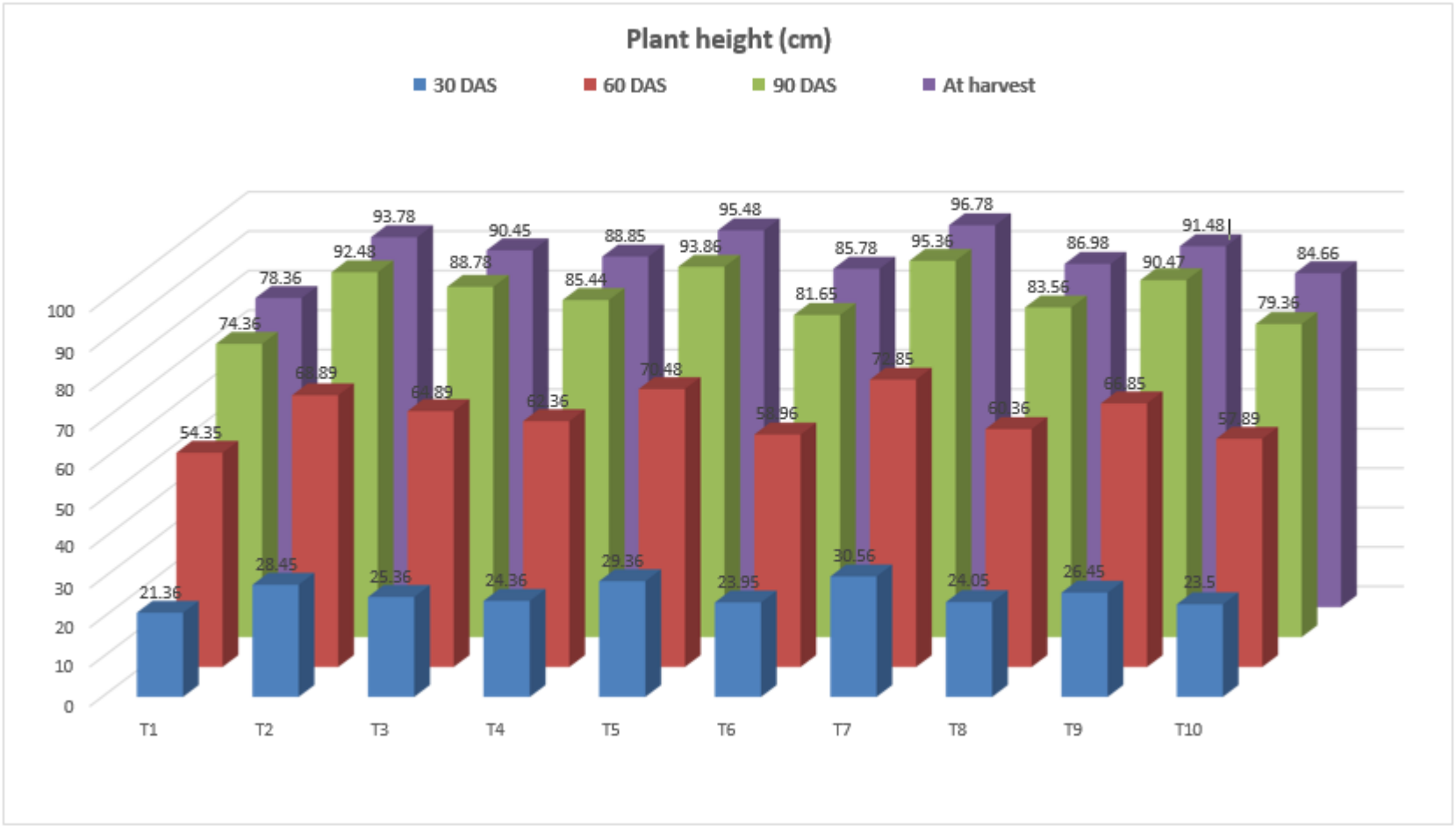

Fig. 1. Effect of different nutrient combination on plant height of barley at different growth stages

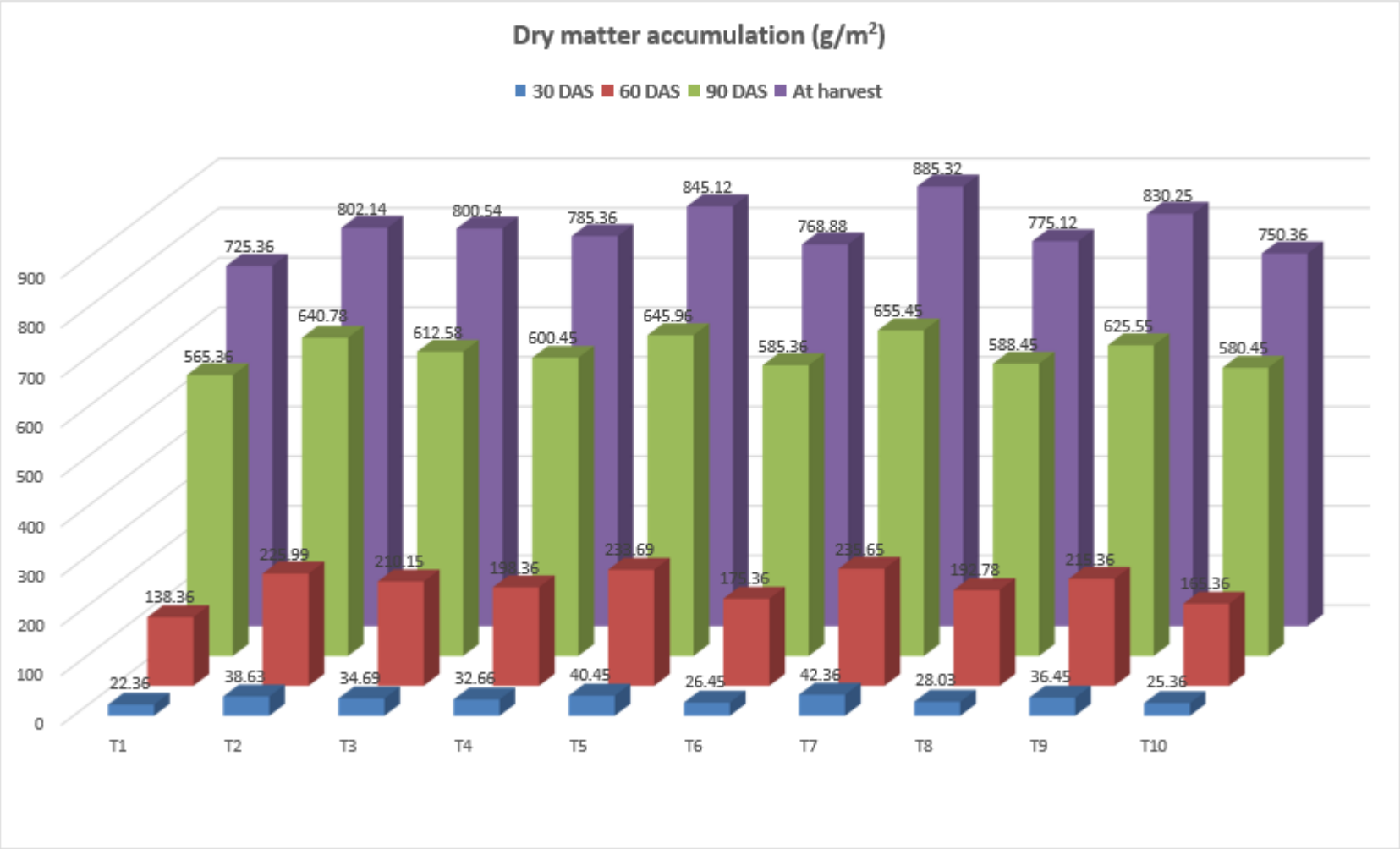

Fig. 2. Effect of different nutrient combination on dry matter accumulation of barley at different growth stages

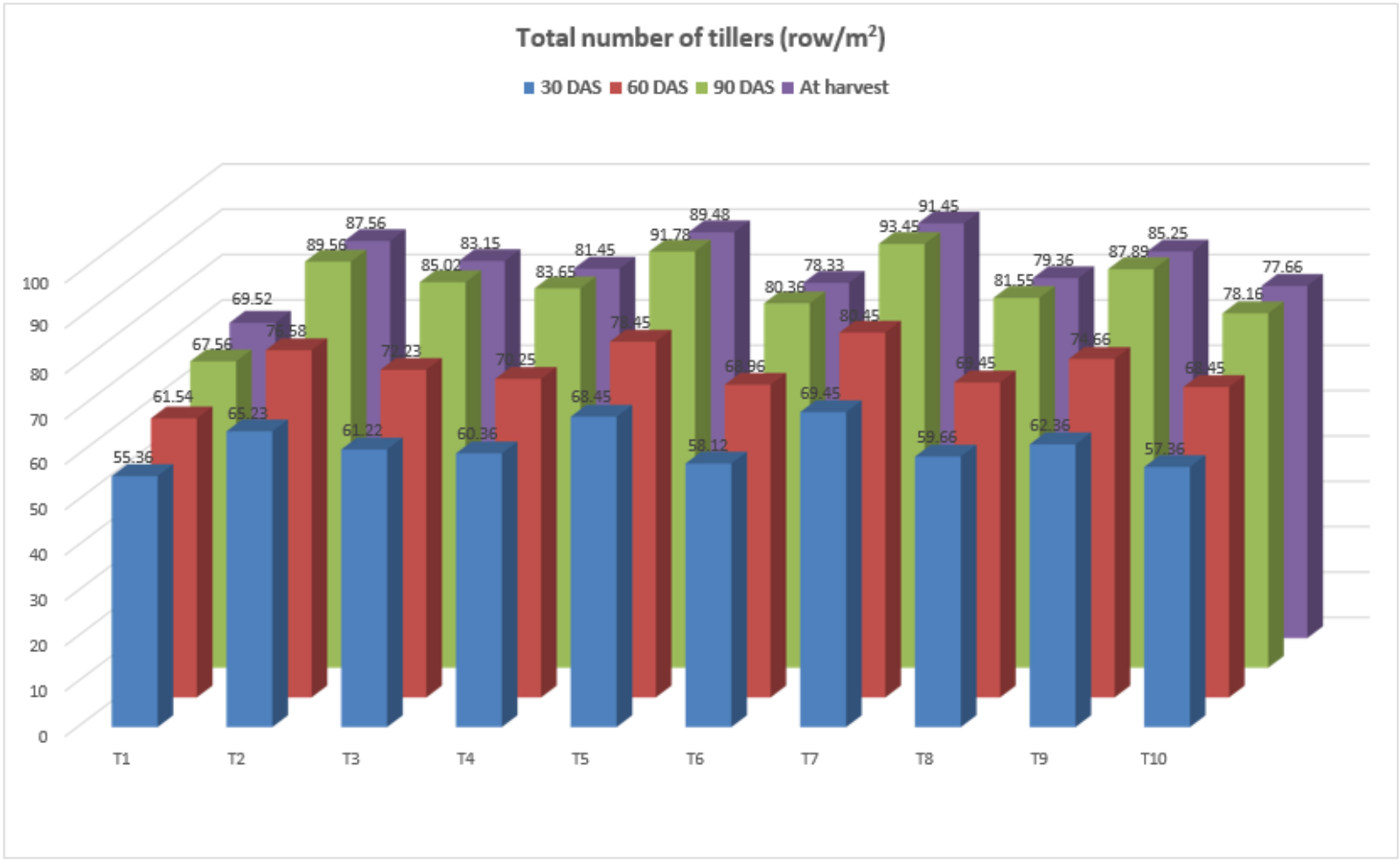

Fig. 3. Effect of different nutrient combination on total number of tillers of barley at different growth stages

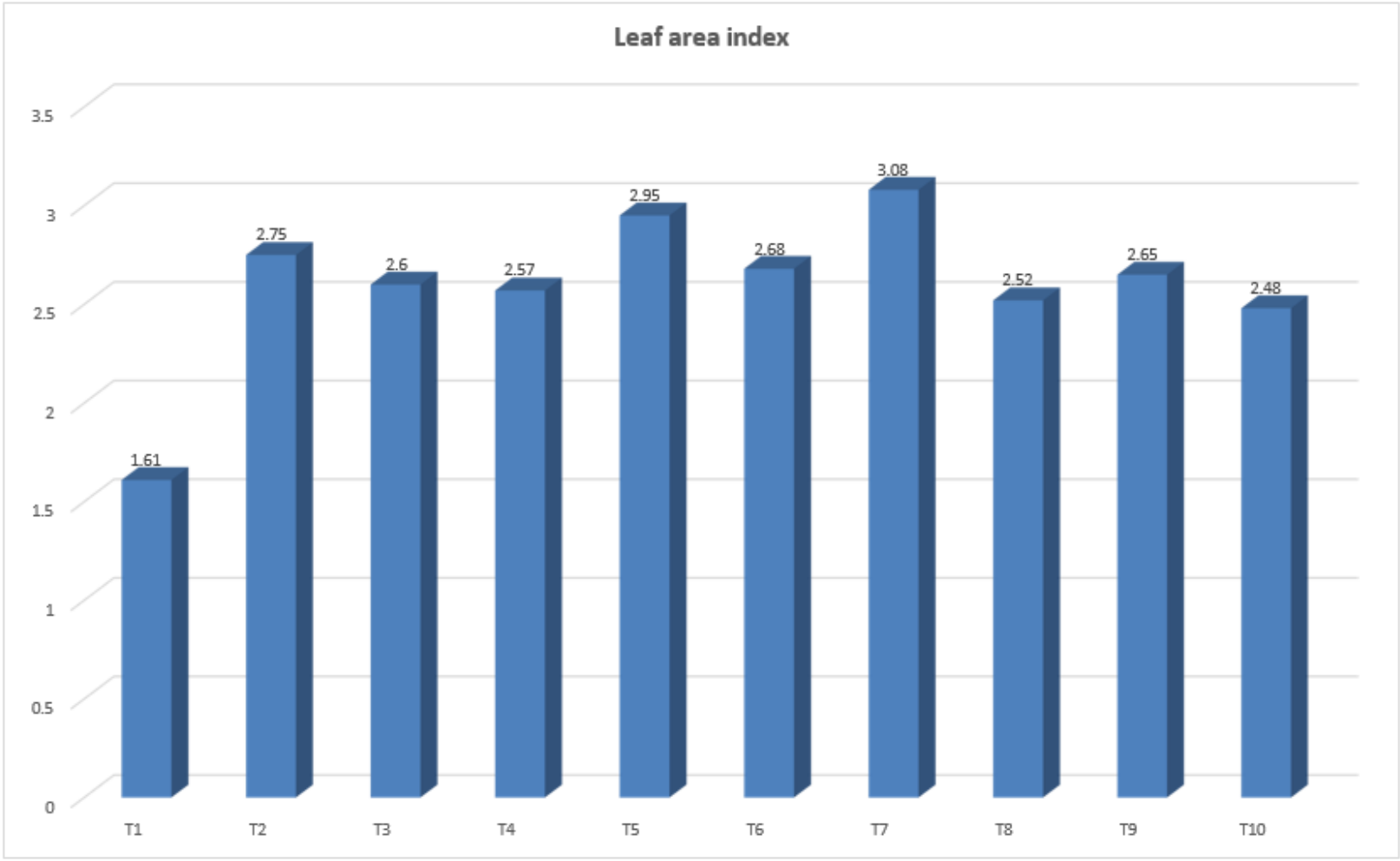

Fig. 4. Effect of different nutrient combination on leaf area index of barle

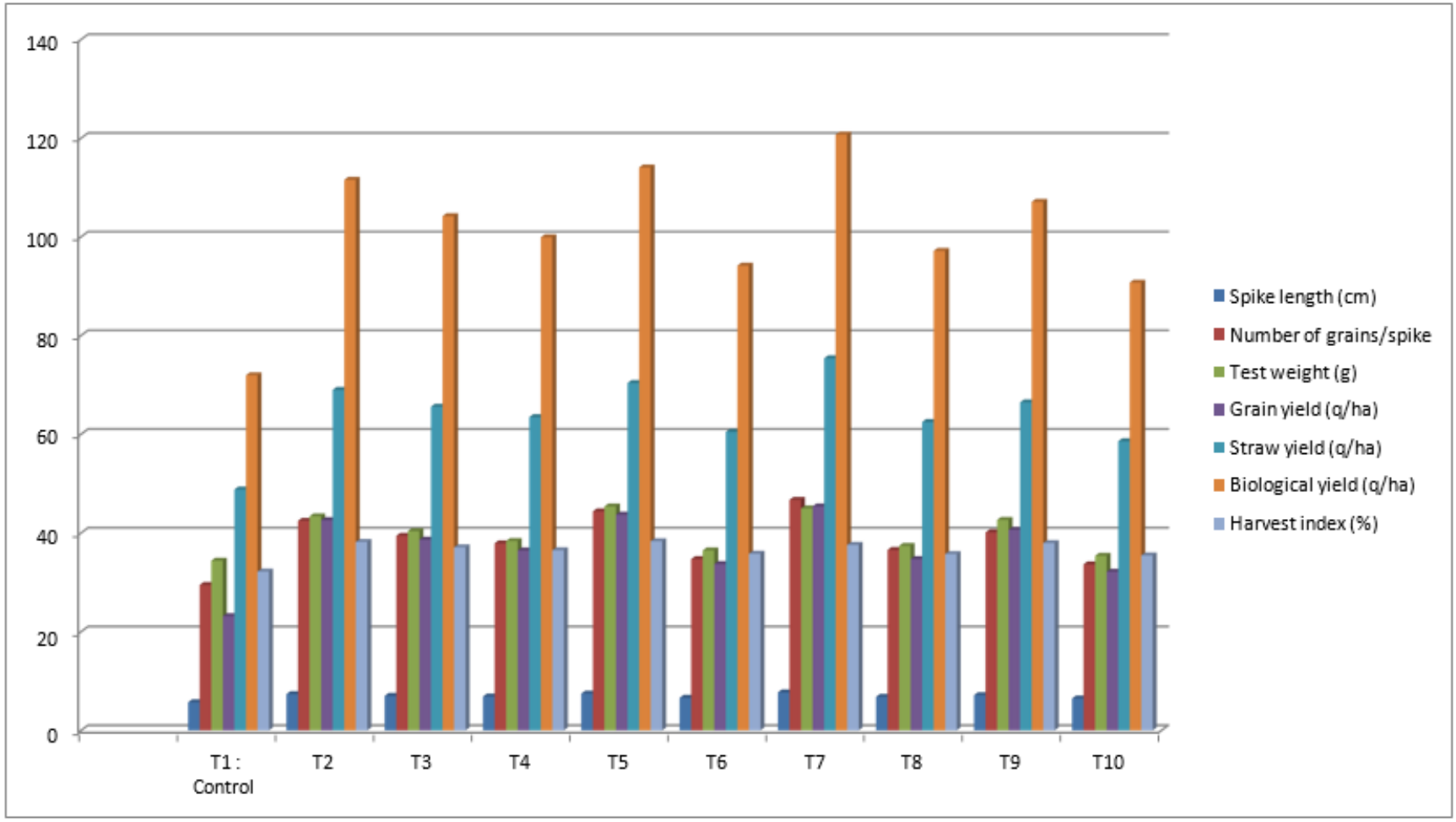

Fig. 5. Effect of different nutrient combination on yield attributes and yield of barley

4. CONCLUSION

Barley (*Hordeum vulgare* L.) is an important winter (*rabi*) cereal crop of India. Being the most dependable crop in alkali soils and areas where frost or drought occurs, it iscultivated in almost all parts of the world.On the basis of experimental finding, it can be concluded that, higher growth and yield of the Barley variety „ RD-2035" can be obtained with the combined application of 75% RDF + 1t Poultry manure.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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