DeterminingtheeffectofIntegratedNutrientManagementonGrowthandYieldofBarley(HordeumvulgareL.)

Abstract

A field experiment was conducted at experimental farm, Department of Agronomy,FacultyofAgricultureandVeterinarySciences,MewarUniversityGangrar,Chittorgarh(Rajasthan) duringRabiseasonof2022-23to determineeffectofintegrated nutrient managementongrowth and yield characters of barley.~~v~~Variety "Rd-2036" was used in this study. ~~The requiredquantitiesoffertilizersaspertreatmentswereapplied~~.Theexperimentwaslaidoutinrandomize dblock design with three replications consisting of nine treatments combinations. The increasedyieldparametersuchasnumberofpersiliqua,seedyield,stoveryieldandharvestindexwasrecordedwith T_9 (Azotobacter + PSB + 30 kg ha^{-1} N through inorganic Fertilizer + 30 kg ha^{-1} N throughpoultrymanure).Thedatarevealedthatthemaximumplantheight(97.05~~c~~cm),totalnumbersof tillers (70.25) and ~~yield attributes~~spike length (7.68 cm), number of grains/spike (44.96), grainyield(42.58q/ha),straw yield(60.15q/ha),biologicalyield(102.73q/ha)andnetreturn(53406.30Rs/ha)was recordedwith treatmentT_5-75%RDF+PSB +Azotobacter.

Keywords:-INM;Barley;Azotobacter; Yield

Comment [D1]:

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Comment [D3]: Insert treatments instead

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Comment [D5]: Number of what?

Comment [D6]: Rewrite and clarify this sentence.

Comment [D7]: Tillers per what?

Comment [D8]: Define this abbreviation

1. Introduction

Barley(*Hordeumvulgare*L.)istheworld´sfourthmostimportantcerealcropafterwheat,rice and maize and the most dependable crop in alkali soils and areas where frost or droughtoccurs. The major barley producing countries are China, Russia, Germany, USA, Canada, India,Turkey and Australia. The major use of barley grain is in brewing industries for manufacturingmalt which is used to make beer, industrial alcohol, whisky, malt syrups, brandy, malted milk,vinegarandyeast. In India,barleyismainlygrowninthe northernplainsandconcentratesinthestatesof Rajasthan, Haryana, Punjab and westernUP.

Nitrogen is universally deficient plant nutrient in most of the Indian soils. Nitrogen is anessentialconstituentofmanycompoundssuchasnucleotides,phospholipids,enzymes, hormonesandvitaminetc.Itgovernstoaconsiderabledegreetotheutilizationofcarbohydrates,potassium and other elements. Nitrogen being an essential constituent of protein nucleic acidandchlorophyllplaysamajorroleinphotosynthesisandchlorophyllsynthesis(Kanwar,1976).Phosphorus is another important nutrient next to nitrogen. At present 49.3% of the Indian soilsareunderlowcategory,48.8%undermediumand1.9%underhighcategoryofP(Pattanayak*etal.*, 2009).

Comment [D9]: This is old good if you replace with other reference

Over use of chemical fertilizers harms the biological power of soil, which must bepreventedasallnutrienttransformationarenegotiatedbysoilmicroflora.Organicmatteristhesource of energy to the soil micro flora and organic carbon content and it is considered to beindex of the soil health. Organic materials are intrinsic and essential component of all soils andmakethesoilalivingdynamicsystem.Organicmatterservesasareservoirofnutrientsthatareessentialfor plant growth(Kumar*et al.* 2017).

Comment [D10]: Use conjunction before this sentence

Bio-fertilizers can play an important role in meeting the nutrient requirement of cropsthroughbiologicalnitrogenfixation(BNF),solubilizationofinsolubleformsofnutrients,stimulation of plant growth and decomposition of plant residues. Azotobacter is a free-livingbacterium in non-legume crop and secretes some growth promoting substances. Azotobacter isreportedtohavebeneficialeffects onalmost allthecereals crops Tetarwal*etal.*(2021).

The vermicompost~~vermicomposting~~is a rich source of macro and micronutrients, vitamins, enzymes,antibiotics and growth hormones. Apart from the balanced supply of nutrient it improves thefertilizer and wateruseefficiency evenbetter thanFYM(Dayal and Agarwal,1998).

2. MaterialsandMethods

AfieldexperimentwasconductedduringRabiseasonof2022-23atexperimentalfarm,Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar UniversityGangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam intexture,salineinreactionwitha pHvalueof7.6,poorinorganic carbon(0.16%), deficientinavailablezinc(0.48ppm)andiron(1.2ppm)lowinavailablenitrogen(176kg/ha)andphosphorus(20.2kg/ha)but mediuminavailablepotassium(320kg/ha).Theexperimentwas laidoutinrandomized block design with three replications consisting of nine treatments *viz;* Control,100%RDF,75%RDF+Azotobacter,75%RDF+PSB,75%RDF+PSB+Azotobacter,50% RDF+2tFYM+Azotobacter,50%RDF+2tFYM+PSB,50%RDF+2tFYM+Azotobacter + PSB and 50% RDF + 1 t Vermicompost. The required quantities of fertilizers as pertreatments were applied. The doses of NPK were applied in the form of urea, diammoniumphosphate andmurateofpotash, respectively.

Comment [D11]: For how money years?

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Comment [D13]: It is better to express quantity of fertilizer in kilogram per hectare

3. ResultsandDiscussion

3.1 Growthattributes

3.1Yield attributesandyield

Data revealed at 30, 60, 90 DAS and at harvest that the effect of integrated nutrientmanagement significantly influenced the plant height (Table 1.0 and figure 1.0). The maximumplant height (29.56, 72.22, 93.15 and 97.05 cm) was recorded with the treatment T_5-75% RDF +PSB+Azotobacter.Theminimumplantheightwasrecordedat T_1-Controltreatment(21.14,52.50,74.85and78.36cm),respectively.Thisresultalsosupportedby Chauhan*etal*.(2014)andSingh*etal*.(2013).

Comment [D14]: Define this abbreviation

Comment [D15]: At what stage?

Data revealed at 30, 60, 90 DAS and at harvest that the effect of integrated nutrientmanagement significantly influenced the number of total tillers (Table 1.0 and figure 2.0). Themaximum total number of tillers (68.12, 78.96, 92.45 and 90.per m row length) was recordedwith the treatment T_5-75% RDF + PSB + Azotobacter. The minimum total number of tillers wasrecorded T_1-Control treatment (52.45, 60.14, 68.14 and 66.36 per m row length), respectively.Similarfindings also reported by Laghari*et al*. (2010)and Dhaka*et al*. (2012).

Data revealed that the effect of integrated nutrient management significantly influencedthe spike length (Table 2.0). The maximum spike length (7.68 cm) was recorded with thetreatment T_5-75% RDF + PSB + Azotobacter. The minimum spike length (Table 2.0) wasrecorded at T_1-Control treatment (6.92 cm). Data revealed that the effect of integrated nutrientmanagement significantly influenced the number of grains/spike (Table 2.0). The maximumnumberofgrains/spike(44.96)wasrecordedwiththetreatmentT_5-75%RDF+PSB+Azotobacter. The minimum number of grains/spike was recorded at T_1-Control treatment (30.25).Thisfindings also confirmedby Roy and Singh(2016)and Mubarak andSingh (2017).

Data showed integrated nutrient management had a considerable impact on grain output(Table2.0andfigure3.0).ThetreatmentT_5-75%RDF+PSB+Azotobacterproducedthehighestgrain yield (42.58 q/ha), The minimum grain yield was recorded T_1-Control treatment (25.14q/ha). The treatment T_5-75% RDF + PSB + Azotobacter produced the highest straw yield (60.15q/ha). The minimum straw yield was recorded at T_1-Control treatment (48.78 q/ha). The treatmentT_5-75% RDF + PSB + Azotobacter produced the highest biological yield (102.73 q/ha). Theminimum biological yield was recorded at T_1-Control treatment (73.92 q/ha). Similar result was alsoreportedby Bhakher*et al*. (2010)and Tiwari*et al*.(2014).

3.2Economicsvariability

Costofcultivationfixedcost(foralltreatments)isincludedinthischapter.Cultivationexpensesforeverytherapy.Foranytreatmentcombination,thetotalcostofcultivationconsistsofthegrossreturnandgrainandstrawyield(qha^{-1}).Followingpost-harvestobservation,theeconomicviabilityofeachtreatmentwascalculatedtodeterminethecostofcultivation,grossprofit,return,netprofit,andbenefitcostratiofor thebarleycrop.Thebenefitcostratioandtreatment economics statistics have been calculated and are shown in table 3.0, correspondingly.NotespertainingtoeconomicsareprovidedinTable3.0.Whencomparedtoothertreatmentcombinations,treatmentT_5-75%RDF+PSB+Azotobacterhadthehighestgrossreturn(85906.30Rs/ha),netreturn(50908.75Rs/ha),andbenefit-costratio(1.59).Theeconomicanalysisdemonstratesbarleycultivation'sgreatpromise.SimilarresultalsoconfirmedbyMalik (2017)and Kumar*et al*. (2021).

Conclusion

On the one-year experimentation the application of T_5-75% RDF + PSB + Azotobacterfoundtobemostsuitabletogetmaximumcropyield.However,theapplicationof75%recommended dose of fertilizer also found to be most suitable dose for good crop yield andeconomicallysuperior.

Table.1.0Effectofintegrated nutrientmanagementongrowthattributesofbarleyatdifferentgrowthstages

Treatments	Plantheight(cm)				Totalnumberoftillers(m/row)			
	30DAS	60DAS	90DAS	Atharvest	30DAS	60DAS	90DAS	Atharvest
T_1-Control	21.14	52.50	74.85	78.36	52.42	60.14	68.14	66.36
T_2-100%RDF	28.68	70.44	90.45	95.44	64.25	74.14	88.63	85.36
T_3-75%RDF+Azotobacter	26.78	69.47	88.45	92.77	60.12	71.25	82.85	81.36
T_4-75%RDF+PSB	26.44	67.85	87.89	90.65	58.36	70.96	82.36	79.36
T_5-75%RDF+PSB+Azotobacter	29.56	72.22	93.15	97.05	68.12	78.96	92.45	90.12
T_6-50%RDF+2t FYM+Azotobacter	25.14	65.11	85.44	88.25	56.74	68.96	80.14	77.14
T_7-50%RDF+2t FYM+PSB	24.66	62.96	83.47	86.36	55.66	66.35	78.35	75.36
T_8-50%RDF+2t FYM+Azotobacter+PSB	28.12	69.35	89.69	93.47	62.14	73.14	86.47	84.36
T_9-50%RDF+1t Vermicompost	23.25	62.52	83.02	85.45	54.33	65.96	77.85	74.15
SEm±	0.40	0.75	1.14	1.22	2.02	2.13	3.08	2.70
CDat 5%	1.19	2.26	3.39	3.65	6.06	6.32	9.36	8.10
CV%	7.45	7.98	9.85	9.15	7.88	93.75	10.45	9.33

Table.2.0Effectofintegrated nutrientmanagementonyield attributesandyield ofbarley

Treatments	Number ofeffective tillers	Spike length(cm)	Number ofgrains/spike	Grain yield(q/ha)	Strawyield (q/ha)	Biological yield(q/ha)
T_1-Control	56.36	5.75	30.25	25.14	48.78	73.92
T_2-100%RDF	68.66	7.02	42.36	40.05	58.36	98.41
T_3-75%RDF+Azotobacter	64.25	6.85	37.66	37.36	53.69	91.05
T_4-75%RDF+PSB	63.36	6.8	35.36	35.47	52.12	87.59
T_5-75%RDF+PSB+Azotobacter	70.25	7.68	44.96	42.58	60.15	102.73
T_6-50%RDF+2t FYM+Azotobacter	62.12	6.62	34.96	33.69	51.78	85.47
T_7-50%RDF+2t FYM+PSB	60.02	6.55	33.85	30.14	50.36	80.5
T_8-50%RDF+2t FYM+Azotobacter+PSB	66.15	6.92	40.36	39.36	54.36	93.72
T_9-50%RDF+1t Vermicompost	59.30	6.52	32.22	28.36	49.66	78.02
SEm±	1.36	0.22	1.20	2.34	1.29	3.72
CDat 5%	3.95	0.68	3.61	6.98	3.86	11.12

Table3.0Effectofintegratednutrientmanagement oneconomics

Treatments	Costofcultivation (Rs/ha)	Grossreturn (Rs/ha)	Netreturn (Rs/ha)	B:Cratio
T_1-Control	16800	48186.25	31386.25	1.53
T_2-100%RDF	30250	81158.75	50908.75	1.59
T_3-75%RDF+Azotobacter	27859	75557.60	47698.60	1.58
T_4-75%RDF+PSB	25850	71964.45	46114.45	1.56
T_5-75%RDF+PSB +Azotobacter	32500	85906.30	53406.30	1.60
T_6-50%RDF+2tFYM+Azotobacter	24600	68808.15	44208.15	1.55
T_7-50%RDF+2t FYM+PSB	22100	62364.90	40264.90	1.54
T_8-50%RDF+2t FYM +Azotobacter+PSB	29000	79161.60	50161.60	1.57
T_9-50%RDF+1 t Vermicompost	21950	61580.00	39630.00	1.55

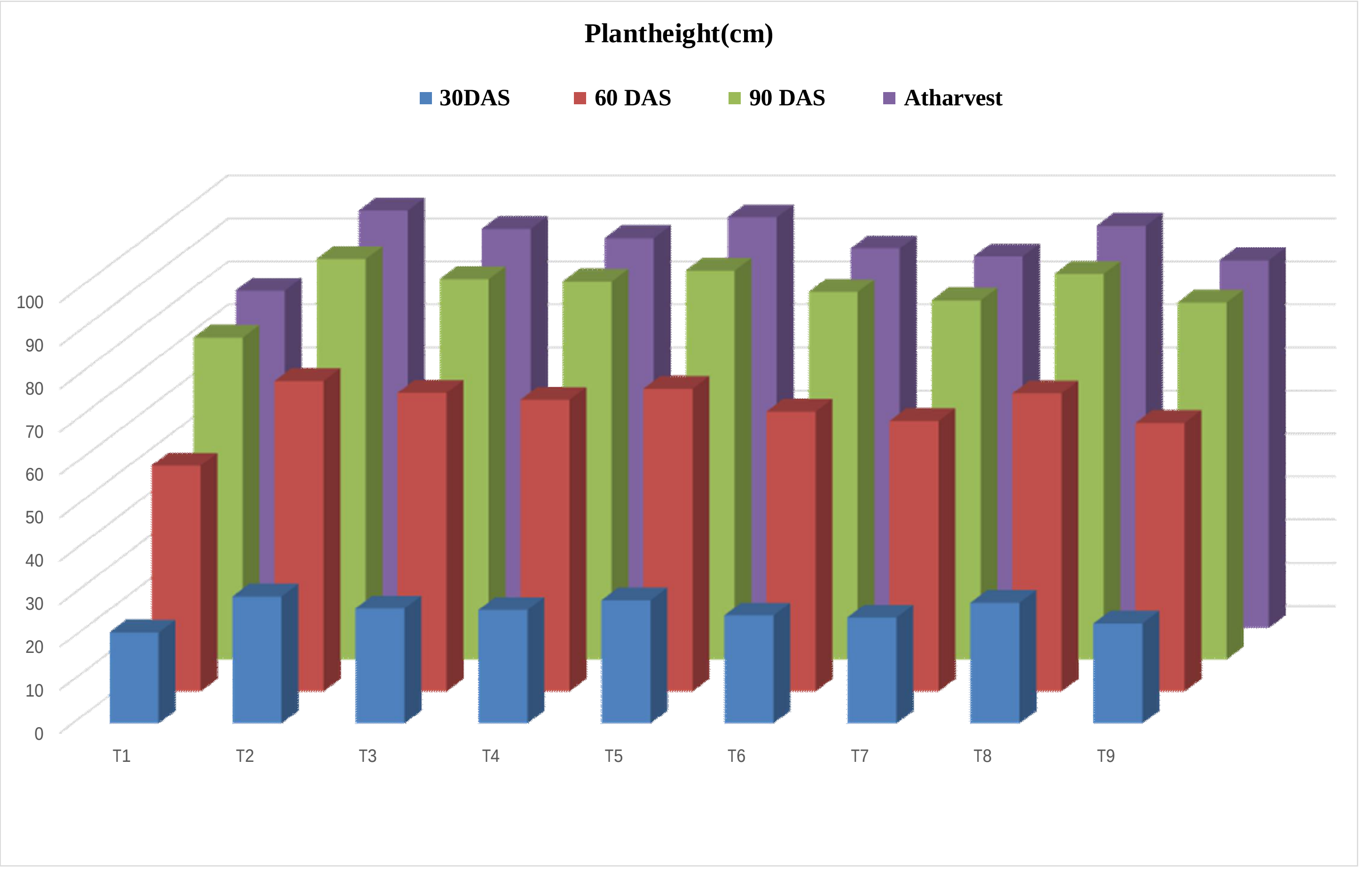

Fig.1.0Effectofintegratednutrientmanagement onplantheightofbarley

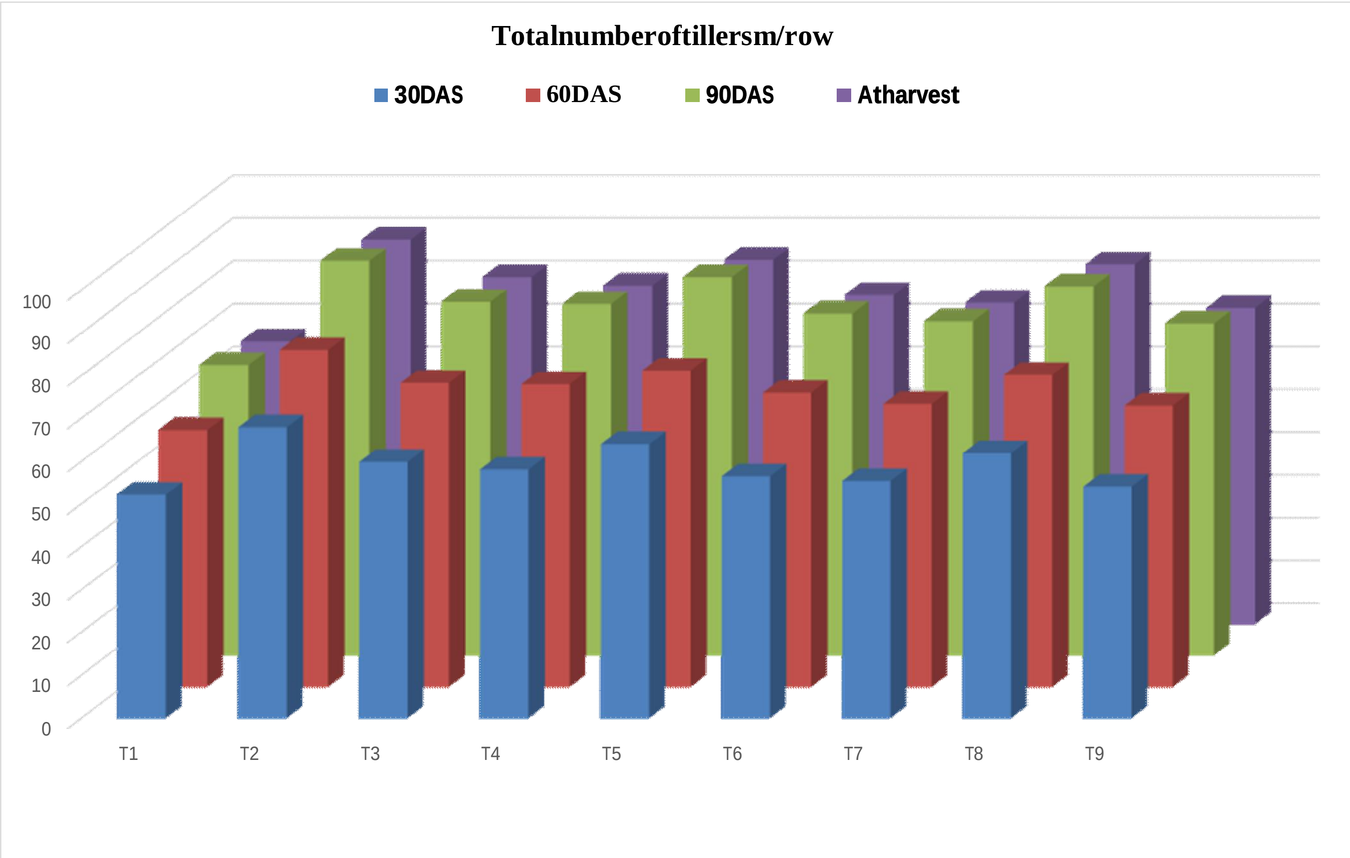

Fig.2.0Effectofintegratednutrientmanagementontotalnumberoftillers ofbarley

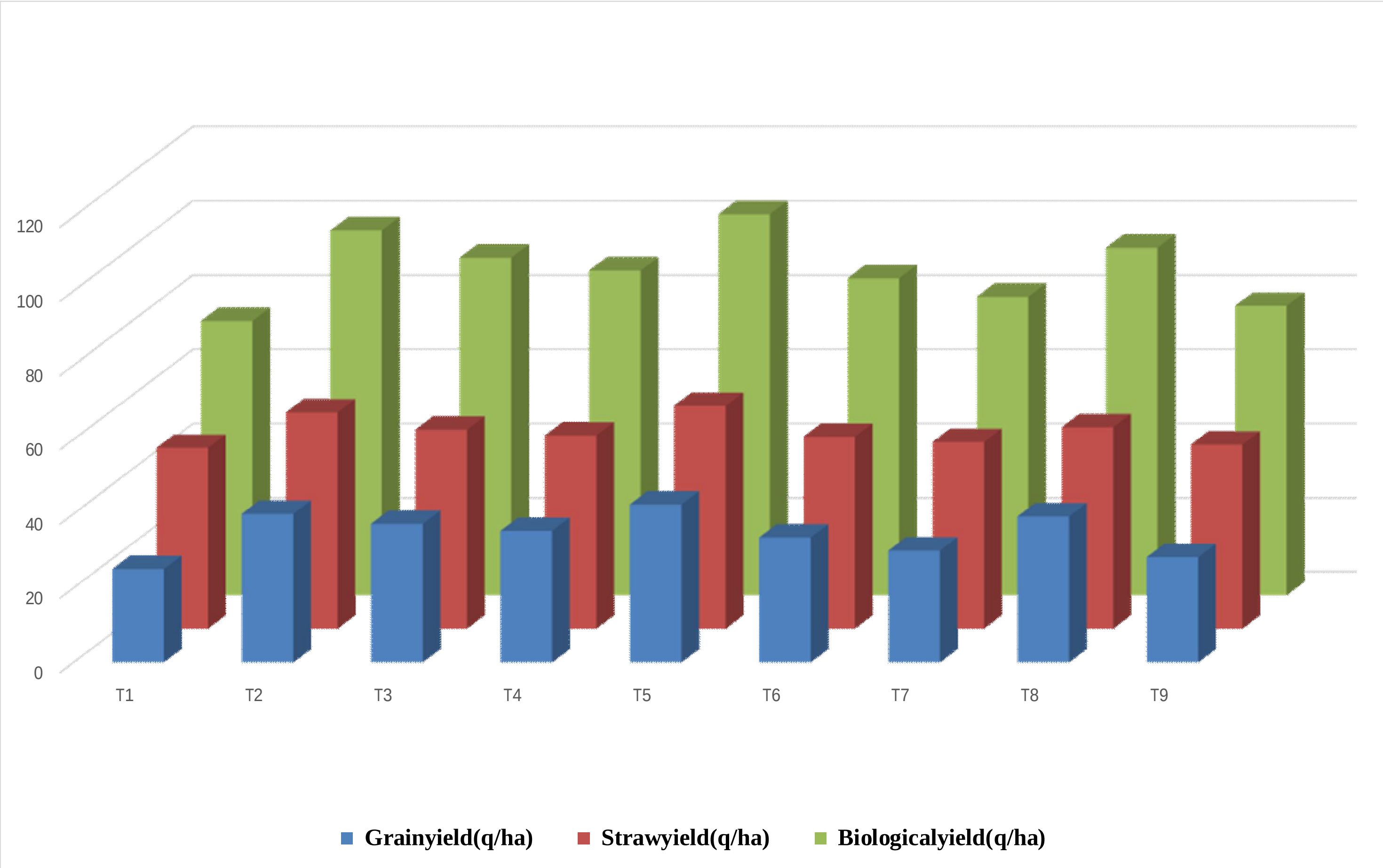

Fig.3.0Effectofintegratednutrientmanagement onyieldofbarley

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