Original Research Article

Effectofnitrogenmanagementongrowthattributesandyieldattributesofwheat

ABSTRACT

A field experiment was conducted during *rabi* 2022 at Crop Research Farm, Department ofAgronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P)to determine the "Effect of Nitrogen management on growth and yield of wheat". There were ninetreatments each replicated thrice and the experiment was laid out in Randomized Block Design. Theresults showed that treatment 6 (75% N through urea + 25 % N through poultry manure) recordedsignificantly higher plant height (119.20 cm), maximum number of tillers/ m^2 (214), higher plant dryweight (64.34 g), highest Crop growth rate during the interval of 50-75 DAS (35.73 g/m^2/day),maximumnumberofeffectivetillers/m^2(144.5),maximumnumberofgrains/spike(53.33)andhighertestweight(97.71g)comparedtoothertreatments.

Keywords*:Wheat,Urea,Vermicompost,Poultrymanure,GrowthandYieldattributes*

INTRODUCTION

India'ssecond-largestgraincrop,wheat,isessentialtothenation'sfoodandnutritionalsecurity.Nearly55%oftheworldpopulationdependsonwheatforabout20%ofcaloriesintake.Itisoneofthemajorfoodgrainsofthecountryandastaplefoodofthepeopleof NorthIndia,wherepeoplehavepreferenceforchapatti.Wheatisaself-pollinated,longday,wintercropandbelongstotheplantfamilyPoaceae.It is grown for grains as well as for fodder purposes to fulfil human and livestock requirements. Thelowerproductionisduetoinappropriatelevelandtimingoffertilizers,alkalinity,nitrogenandorganicmatterdeficitsoilsofthearea.Thediverseenvironmentalconditionsandfoodhabitsofpeoplein Indiasupportsthecultivationofthreetypesofwheat(bread,durumanddicoccum).

Thetotalareaofwheatcultivationaroundtheworldis221.91millionhectares,thetotalproductionwas 781.01 million metric tons, and the productivity per hectare was 3.52 metric tons (**USDA, 2022**). Thetotal sown area under wheat crop in India is around 31.61 million hectares. The total wheat production inIndia is around 109.52 million tons and productivity of 3464 kg/ hectare. Total area under wheat inUttar Pradesh is 9.85 million hectares which is 31.16 % of total area under wheat cultivation in India.Total wheat production in Uttar Pradesh is 35.50 million tons and productivity is 3604 kg/ hectare**(GOI,2022)**.

Nitrogeninsufficiencyinfluencesbiomasssynthesisanduseofsunenergyforproductivityoftheplant,withan extraordinaryeffectongrainyieldandyieldcontributingparameters**(Heinemann*etal*.,2006)**.The inconsistency in soil and climatic conditions related with forms that influence nitrogen elementsintherootzoneandtheirassociationwiththeplantmaypromptvariationinnitrogenaccessibilityandits necessity to plant **(Simili*et al*., 2008)**. Furthermore, the arrival of new cultivars with variousrequirement for their nutrition upsets summed up proposals of nitrogen fertilizers for wheat crop. Theenthusiasm for boosting wheat yields has urged progressive farmers to perform the farm managementoperationsintensively.Itshouldbekeptinmindthattheoptimizedlevelofnitrogenapplicationshouldbe low for the cultivar less responsive to its application and the rate of nitrogen should be high for thevariety that is more responsive to its application and records more yield otherwise yield potential ofthe varieties would be decreased. However sometimes more application of nitrogen results in toxicityandharmstheplantgrowthbymakingit moresusceptibletolodging,causing environmentalpollutionthroughnitrateleaching**(Riley*et al*.,2001)**and volatilization in formofammonia**(Ma*et al*.,2010)**.

Urea is one of the most widely used nitrogen-containing fertilizers. Nitrogen is the major element ofchlorophyll, protein and amino acids and play an important role in wheat productivity **(Khalil,**

2008).Dwarfed wheat growth and lodging were recorded due to under-and over-application of nitrogenrespectivelythantheoptimumlevel**(Hawkesford,2014)**.

Nitrogen enhances spike population and has a greater contribution in yield components **(Maqsood *etal*., 2014)**, increased leaf area index and grain yield **(Bashir *et al*., 2017**). Research on syntheticnitrogen fertilizers depleted soil nitrogen (Mulvaney et al., 2009) showed that inorganic N fertilizersmainly in ammonium form reduced the mass of organic carbon due to more consumption throughmicroorganisms and decreased total nitrogen within the soil because of more nitrogen uptake by thegrains. (**Chaudhary *et al*., 2009)** have reported that high cost, degradation of soil and environmentalpollutionarethemajorproblemsofcommercialfertilizerappliedalone.

Vermicompost is a product of bio-oxidation and stabilization of organic material involving the jointaction of earthworm and microorganisms. Although, microbes are responsible for the biologicaldegradation of the organic matter, earthworms are the important drivers of the process, conditioningthe substrate and altering biological activity **(Aira *et al*., 2002)**. Vermicompost may be potentialsources of nutrients for field crops if applied in suitable ratios with synthetic fertilizers. The earlierworkers have reported a positive effect of vermicompost application on growth and productivity ofcerealsandlegumes**(Suthar,2006)**.Inadditiontoconsiderableamountofnutrientswithhugeamountof beneficial microbial population, vermicompost also contains cytokinins, auxins, gibberellins likebiological active growth promoting substances. It may be used alone or in combination with otherorganicandinorganicfertilizersinorderto getagoodqualitativeand quantitativeyield.

Poultry manure (PM) is a rich source of macro (N, P, K) and micro (S, Fe) nutrients and also has abetter effect on soil health. It serves as an organic matter for the soil, improves soil biological life andenhanced soil water holding capacity. Mineralization of PM is higher than other natural manures(cattle,pig)thusitreadilyreleasesitsnutrientswhenaddedtothesoilforplantuptake.Applicationofp oultry manure increases carbon content, water holding capacity, aggregation of soil, and decreasesbulkdensity.Poultry manure contains 3-5%nitrogen; 1.5-3.5% phosphorus, 1.5-3% potassium,considerableamountofmicronutrientsanditspHis6-7**(Chastain*etal*.,2001)**.Incereals,applicationof poultry manure in integration with urea improves yield components more than other organicmanures **(Khaliq *et al*., 2004)**. Integration of poultry manure and urea helps to restore degraded soilsandisalsomoreeconomicalthansoleapplicationofurea**(Monedero*etal*.,2004)**.Ithasbeenobservedthat improving nitrogen use efficiency increases yield, activates low affinity transport system ofnitrogen uptake in which passive uptake of nitrogen takes place that results in high yield **(Cui *et al*.,2008)**.

MATERIALANDMETHODS

A field experiment was conducted during *rabi* 2022 at Crop Research Farm, Department ofAgronomy, SHUATS, Prayagraj (U.P) on the topic "Effect of nitrogen management on growth andyieldofwheat",tostudytheresponseofnitrogenthroughureaalongwithcombinationofvermicompost and poultry manure. The soil of experimental plot was sandy loam in texture, soil pHwas8.0,lowinorganiccarbon(0.62%),availableN(225kg/ha),availableP(38.2kg/ha)andavailableK (240.7 kg/ha). There were 9 treatments, each being replicated thrice and laid out in RandomizedBlock Design. The treatment combinations were 100% N through urea, 75% N through urea + 25 %Nthroughvermicompost,50% Nthroughurea+50%Nthroughvermicompost, 25%Nthroughurea
+ 75% N through vermicompost, 100 % N through vermicompost, 75% N through urea + 25 % Nthroughpoultrymanure,50%N throughurea+ 50%Nthroughpoultrymanure,25%Nthroughurea
+ 75 % N through poultry manure, 100 % N through poultry manure. The data recorded on differentaspects of crop such as, growth attributes and yield attributes were subjected to statistical analysis byanalysisofvariancemethod(**GomezandGomez,1984**).

RESULTANDDISCUSSION

Growth

attributesPlanthei

ght (cm)

Significantandhigherplantheight(119.20cm)wasrecordedintreatment6(75%Nthroughurea+ 25%Nthroughpoultrymanure).However,treatment7(50%Nthroughurea+50%Nthroughpoultrymanure) was found to be statistically at par with treatment 6 (75% N through urea + 25 % N throughpoultry manure). Significant and higher plant height was recorded with 75% N through urea might bedue to nitrogen application increases, the plant cell size expands, the protein content of the cells rises,increasing leaf area and photosynthesis rate and ultimately causing the plant to grow taller. Similarresults were reported by **Wysocki *et al.* (2007)**. Further, increase in plant height with application of25% N through poultry manure may be due to increased nitrogen availability for cell elongation,development, photosynthesis, and metabolism and buildup of nitrogen together with other assimilatesinflagleaf, whichcausestheirrapidgrowth.Similar resultswerereportedby**Haberle*etal.*(2008).**

Numberoftillers/m^2

Significantandhighernumberoftillers/m^2(214.0)wasrecordedintreatment6(75%Nthroughurea + 25 % N through poultry manure). However, treatment 2 (75% N through urea + 25 % N throughvermicompost) and treatment 7 (50% N through urea + 50 % N through poultry manure) were foundto be statistically at par with treatment 6 (75% N through urea + 25 % N through poultry manure).Significant and higher number of tillers/ m^2 was recorded with 75% N through urea might be due toboosted nitrogen reduced tiller mortality and increase tiller production from the main stem levels.Similar results were also reported by **Rahman *et al.* (2014)**. Further, increase in number of tillers/ $m^2$with application of 25% N through poultry manure may be due to increased availability of nutrientsandtheireaseofabsorptionbyreceivingplants,whichacceleratedtheirplantgrowthanddevelopmen tandultimatelyproduced moretillers/m^2.Similarresultswerealsoreportedby**Enujeke(2013)**.

Plantdryweight(g)

Significant and higher plant dry weight/ plant (64.34 g) was recorded in treatment 6 (75% N throughurea+25%Nthroughpoultrymanure).However,treatment7(50%Nthroughurea+50%Nthroughpo ultry manure) was found to be statistically at par with treatment 6 (75% N through urea + 25 % Nthrough poultry manure). Significant and higher plant dry weight was recorded with 75% N throughurea might be due to nitrogen increases leaf area, photosynthesis occurs more quickly, assimilates areproduced at a higher rate and plant dry matter is produced at a higher pace, leading to a rise in plantdryweight.Similarresultswerereportedby**Rahman*etal.*(2014).**Furtherincreaseinplantdryweightwit happlicationof25%Nthroughpoultrymanuremaybeduetowheat'sphotosyntheticpigmentsandchlorophyl l content increased as a result of the N, increasing the plant's net photosynthetic rate, thehigher net photosynthetic rate resulted in higher dry matter of the plant. Similar results were reportedby**Iqraetal.(2021).**

Cropgrowthrate(g/m^2/day)

At50-75DAS,highestcropgrowthrate(35.73g/m^2/day)wasrecordedintreatment7(50%Nthroughurea + 50% N through poultry manure), though there was nosignificantdifference among thetreatments. Significant and higher crop growth rate was recorded with 75% N through urea might bedueto optimalnutrientsutilizationtoensurethenutrientuptakebyplantandtranslocationof

assimilates to various plants parts which led to increased plant biomass, resulting in higher CGR.Similarresultswere reportedby**Wang*etal*.(2010).**

Yieldattributes

Numberofeffectivetillers/m^2

Significantlyhighernumberofeffectivetillers/m^2(14.45)wasrecordedintreatment6(75%Nthroughurea+25%Nthroughpoultrymanure).However,treatment7(50%Nthroughurea+50%Nthroughpoultry manure) was found to be statistically at par with treatment 6 (75% N through urea + 25 % Nthroughpoultrymanure).Significantandhighernumberofeffectivetillers/m^2wasrecordedwith75%Nthroughureamightbeduetoincreasedlevelofnitrogenresultedinmorenumberofleaves,resultinginhigherrate of photosynthesis,assimilation,metabolicactivitiesandcell division,whichledsignificant increase in number of effective tillers/m^2. Similar results were reported by **Chauhan *et al*.(2014)**. Further, increase in number of tillers/ m^2 with application of 25% N through poultry manuremay be due to availability of both macro nutrients and micro nutrients present in the poultry manurewhichincreasedthenumberofeffectivetillers/m^2.Similarresultswerereportedby**Muhammad*etal.* (2018).**

Numberofseeds/spike

Significantlyhighernumberofseeds/spike(55.33)wasrecordedintreatment 6(75%Nthroughurea + 25 % N through poultry manure). However, treatment 7 (50% N through urea + 50 % N throughpoultry manure) was found to be statistically at par with treatment 6 (75% N through urea + 25 % Nthrough poultry manure). Significant and higher number of seeds/ spike was recorded with 75% Nthrough urea might be due to increased photosynthesis rate because of higher dose of nitrogen whichresulted in more amount of dry matter, more assimilates which were produced and transported to fillttheseeds.Similarresultswerereported**Imbad*etal.*(2018)**.Furtherincreaseinnumberofseeds/spikealong with application of 25% N through poultry manure may be due to increased nitrogen rate thatled to an increase in dry matter and more partitioning towards grains, which in turn led to an increaseinthenumberofgrains/spikes.Similarresultswere reportedby**Muhammad*etal*.(2018)**.

Testweight(g)

Significantly higher test weight (97.71 g) was recorded in treatment 6 (75% N through urea + 25 % Nthrough poultry manure). However, treatment 7 (50% N through urea + 50 % N through poultrymanure) was found to be statistically at par with treatment 6 (75% N through urea + 25 % N throughpoultry manure). Significant and higher test weight was recorded with 75% N through urea might bedue to the enormous buildup of proteins and other stored nutrients in the seed, the weight of onethousandgrainsincreased.Similarresultswerereportedby**Azam*etal*.(2010)**.Furtherincreaseintestweight along with application of 25% N through poultry manure may be due to the accumulation ofA-type starch granules is increased by enough nitrogen, A-type starch granules have more amylose,which makes grain rounder and bolder for more starch to accumulate in, increasing grain weight.Similarresultswere recordedby**Wei*etal*.(2010)**.

CONCLUSION

Based on the findings it can be concluded that in wheat with the combination of 75% N through ureaalong with 25% N through poultry manure (treatment 6) was observed highest growth and yieldattributes.

Table1:Effectofnitrogenmanagementongrowthattributesofwheat

S. No.	Treatments	Plantheight (cm)	Numberof tillers/m^2	Plantdry weight(g)	Cropgrowth rate(g/m^2/day)
1.	100%Nthroughurea	108.20	189.3	54.67	32.07
2.	75%Nthroughurea +25%Nthroughvermicompost	113.20	213.0	61.21	37.03
3.	50%Nthroughurea + 50% Nthroughvermicompost	114.80	204.0	59.06	34.17
4.	25%Nthroughurea + 75%Nthroughvermicompost	109.20	190.7	57.53	32.91
5.	100 %Nthroughvermicompost	110.50	180.0	52.00	31.29
6.	75%Nthroughurea +25%Nthroughpoultrymanure	119.20	214.0	64.34	35.73
7.	50%Nthroughurea +50%Nthroughpoultrymanure	116.20	213.7	64.00	35.16
8.	25%Nthroughurea +75%Nthroughpoultrymanure	114.00	200.0	58.31	34.20
9.	100%Nthroughpoultrymanure	106.20	180.0	53.46	33.33
	F–Test	S	S	S	NS
	SEm(±)	1.02	0.34	0.72	1.19
	CD (p=0.05)	3.08	1.03	2.17	-

Table2:Effectofnitrogenmanagementonyieldattributesofwheat

S. No.	Treatments	Numberofeffective tillers/m^2	Numberof seeds/spike	Testweight (g)
1.	100%Nthroughurea	119.8	45.00	87.90
2.	75%Nthroughurea +25%Nthroughvermicompost	140.5	52.33	94.38
3.	50%Nthroughurea + 50%Nthroughvermicompost	134.5	50.00	93.00
4.	25%Nthroughurea + 75%Nthroughvermicompost	121.2	46.67	89.25
5.	100 %Nthroughvermicompost	110.5	42.00	84.00
6.	75%Nthroughurea +25%Nthroughpoultrymanure	144.5	55.33	97.71
7.	50%Nthroughurea +50%Nthroughpoultrymanure	144.2	54.67	96.93
8.	25%Nthroughurea +75%Nthroughpoultrymanure	130.5	49.40	90.51
9.	100%Nthroughpoultry manure	110.0	43.33	85.53
	F–Test	S	S	S
	SEm(±)	0.23	0.68	0.27
	CD (p=0.05)	0.69	2.05	0.82

REFERNCES

Aira,M.,Monrot,F.,Dominguez,J.andMato,S.2002.Howearthwormdensityaffectsmicrobialbiomassandactivityinpigmanure.EuropeanJSoilBiol.,38:7-10.

AzamShah,S.MahmoodShah,WisalMohammad,M.Shafi,HaqNawaz,SamreenShehzadi,M.Amir(2010). Effectofintegrateduseoforganicandinorganicnitrogensourcesonwheatyield.Sarhad J. Agric. Vol.26, No.4.

Bashir,M.U.,S.A.Wajid,A.Ahmad,M.Awais,M.A.S.Raza,G.M.Tahir,U.Saeed,M.H.U.Rehman, M. Waqas and S. Abbas. 2017. Irrigation scheduling of wheat at different nitrogen levels in semi-aridregion.Turk.J.FieldCrops.22(1):63-70.https://doi.org/10.17557/tjfc.303880.

Chastain,J.P.,J.J.CamberatoandJ.E.Albrecht.2001.Nutrientcontentoflivestockandpoultrymanure,climate change central,ClemsonUniversity,USA.36p.

Chaudhry,A.N.,G.Jilani,M.A.KhanandT.Iqbal.2009.Improvedprocessingofpoultrylittertoreducenitrateleaching and enhanceitsfertilizerquality.AsianJ.Chem.21: 4997-5003.

Chauhan T. M, Javed Ali, S. P. Singh and S. B. Singh (2014). Effect of nitrogen and zinc nutrition onyield,qualityanduptakeofnutrientsbywheat.*AnnalsofPlant and SoilResearch*16(2): 98-101.

Cui,Z.L.,F.S.Zhang,X.P.Chen,Y.X.Miao,J.L.Li,L.W.Shi,J.F.Xu,Y.L.Ye,C.S.Liu,Z.P. Yang, Q. Zhang, S.M. Huang and D.J. Bao. 2008. On-farm evaluation of an in season nitrogenmanagementstrategybasedonsoilNMINtest.FieldCrops Research105:48-55.

Enujeke, E.C. 2013.Effects of poultry manure on growth and yield of improved maize in Asaba areaofdelta state,Nigeria.J.Agri.Vet.Sci.4:24–30.

Gomez K. A, Gomez A. A (19840). Statistical procedure for Agriculture research 1st Edn., John WileyandSonspub.,NewYork.

Government of India, Department of Agriculture and Farmers Welfare, Directorate of Economics andStatistics,AgriculturalStatisticsataGlance 2021.

Haberle J, P. Svoboda and I. Raimanova, 2008. The effect of post anthesis water supply on grainnitrogenconcentrationandgrainnitrogenyieldofwinterwheat.Plant,CellandEnvironment54:304-312.

HawkesfordM.J,2014.Reducingtherelianceonnitrogenfertilizerforwheatproduction.J.CerealSci.59(3):276-283. https://doi.org/10.1016/j.jcs.2013.12.001

Heinemann,L.F.Stone,A.D.Didonet,M.G.;Soares,B.B.Trindade,J.A.A.Moreira,A.DCanovas,(2006).Radiationuseefficiencysolarwheatproductivityresultingfromfertilizationnitrogen.BrazilianJournalofEngineeringAgriculturalandEnvironmental.v.10,n.2,p.352-356.

Imdad Ullah, Nasir Ali, Saba Durrani, Muhammad Adeel Shabaz, Abdul Hafeez, Hafeez Ameer,Muhammad Ishfaq, Muhammad Rashid Fayyaz, Abdur Rehman, Abdul Waheed (2018). Effect ofDifferent NitrogenLevelsonGrowth,YieldandYieldContributingAttributesofWheat.*InternationalJournalof Scientific&EngineeringResearch* Volume 9,Issue 9

IqraGhafoor,MuhammadHabib-ur-Rahman,Muqarrab Ali,Muhammad Afzal,Wazir Ahmed,Thomas Gaiser, Abdul Ghaffar (2021). Slow-release nitrogen fertilizers enhance growth, yield, NUEin wheat crop and reduce nitrogen losses under an arid environment. *Environmental science andpollutionresearch*28:43528-43543

KhalilI.A.,2008.Cropsand croppinginPakistan.HEC,Islamabad.pp.71-72.

Khaliq,T.,T.Mahmood,J.KamalandA.Masood.2004.Effectivenessoffarmyardmanure,poultrymanure and nitrogen for corn (Zea mays L.) productivity. International Journal of Agriculture andBiology6:260-263

Ma B. L, T. Y. WU, N. Tremblay, W. Deen, N. B. Mclaughlin, M. J. Morrison, G Stewart, (2010). On-farmassessment oftheamount andtimingofnitrogenfertilizeronammoniavolatilization.AgronomyJournal.v.102,n.1,p.134-144.

Maqsood,M.,M.A.Shehzad,Y.RamzanandA.Sattar.2014.Effectofnitrogennutritionongrowth,yield and radiation use efficiency of different wheat (Triticum aestivum L.) cultivars. Pak. J. Agric.Sci.51(2):441-448.

Monedero,S.M.,C.Mondini,M.Nobili,L.LeitaandA.Roig.2004.Landapplicationofbiosolids.Soil response to different stabilization degree of the treated organic matter. Waste Mnagement 24:325-532.

Muhammad Faheem Jan, Muhammad Dawood Ahmadzai, Waqas Liaqat, Haseeb Ahmad, WazirRehan(2018).EffectofPoultryManureandPhosphorousonPhenology,YieldandYieldComponentsofWheat.Int.J.Curr.Microbiol.App.Sci.(2018)7(5):3751-3760.

RahmanM.Z,M.R.Islam,M.A.KarimandM.T.Islam(2014).Responseofwheattofoliarapplicationofureafertilizer.1(1):39-43.

Riley W. J, I. Ortiz-Monasterio, P. A Matson, (2001). Nitrogen leaching and soil nitrate, nitrite, andammonium levels under irrigated wheat in Northern Mexic. Nutrient Cycling in Agroecosystems. v.61,n.3,p.223-236.

Simili, R. A. Reis, B. N. Furlan, C. C. P. Paz, M. L. P. Lima, P. A. A. Bellingieri, (2008). Responsesorghum-sudan hybrids to nitrogen fertilization and Potassium: chemical composition and in vitrodigestibilityoforganicmatter.ScienceandAgrotechnology.v.32,n.2,p.474-480.

Suthar,S.2006.Effectofvermicompostandinorganicfertilizeronwheat(Triticumaestivum)production,Nature,Env.andPoll.Technol.,5:197-0.

USAD(UnitedStatesDepartmentofAgriculture)2023. WorldProduction,MarketsandTradereport.ForeignAgriculturalService.1-280.https://apps.fas.usda.gov.

WangQ,LiF,Zhao L,ZhangE,ShiS,ZhaoW,VanceMM(2010)Effectofirrigationandnitrogenrates on nitrate nitrogen distribution and fertilizer nitrogen loss, wheat yield and nitrogen uptake on arecentlyreclaimedsandyfarmland.Plantsoil337(1-2):325-339.

Wei,C.X.,J.Zhang,Y.F.Chen,W.D.Zhou,B.Xu,Y.P.Wang andJ.M.Chen.2010.Physicochemicalpropertiesanddevelopmentofwheatlargeandsmallstarchgranulesduringendospermdevelopment.ActaPhysiologiaePlantarum32:905-916.

Wysocki, D. J., M. Corp, D. A. Horneck and L. K. Lutcher (2007). Nutrient Management Guide:Irrigated and Dryland Canola. Oregon State University EM-8943-E. Available from: http://www.extension.oregonstate.edu/catalog/pdf/em/em8943-e.pdf