Carryover effect of green manure, FYM and N-fertilization on the succeedingwheat in rice-wheat cropping system.

ABSTRACT

The present study was carried out PunjabAgriculturalUniversity,RegionalResearch Station, Gurdaspur, during 2020-21 and 2021-22. The experiment was laid out in split-split plot design with three factors. Main plots contain three organic fertilizers treatments, sub plot contains three nitrogen levels andsub-sub plots contain three nitrogen application stage. Plant height of succeeding wheat crop grown after basmati rice was affected non-significantly by organic fertilizers and chemical fertilizers applied to basmati rice during both the years.The number of tillers and dry matter accumulation significant affected during both the years. Greater values were obtained with FYM application @ 15 t ha^{-1} whichwas significantly similar to green manuring but significantly higher than control during both the years. The various nitrogen doses andnitrogen application stages failed to significantly influence number of tillers and dry matteraccumulation of succeeding wheat crop. In case of number of effective tillers and grains per spike, the maximum valueswere obtained with FYM. It was at par with green manuring but significantly higher than. Thenitrogendosesandnitrogenapplicationstageshadnon-significanteffectonboththeseparameters. The organicfertilizers had statistical significant effect on straw and grain yield of wheat crop. The higheststrawandgrainyieldswereobtainedwithapplicationofFYM@ 15tha^{-1}whichwassignificantlyhigherthancontrolbutstatisticallyatparwithgreen manuring during both the years.Theharvestindexwasnon-significantforallthetreatments.The total NPKuptakeinwheatwassignificantlyaffectedbytheorganicfertilizers.HighestuptakeofNPKin grainandstrawwasobservedwithFYMapplicationwhichwasatparwithgreen manuringbutsignificantlyhigher than controlduring both the years.

Key words: Green manuring, FYM, Nitrogen, Succeeding, Wheat

INTRODUCTION

IntheIndo-Gangeticplains,wheatisgrownunderrice-wheatcroppingsystem. This system safeguards the food security and livelihood in the Indian sub-continent,constituting a key part of protein and energy intake by the humans (Singh *et al* 2012). But theproductivity of the wheat crop in rice-wheatcroppingsystem has suffered due to poor rooting caused by sub soilcompaction afterpuddling in rice (Gathala*etal*2011). Further, the sustainability of therice-wheatcroppingsystemisunderthreatduetothenon-judicioususeofchemicalfertilizersresultingindecreasedsoilorganiccarbonandmultinutrientdeficienciesalongwithreducedmicrobiological activity(Paul*etal*2014). The yield under any cropping system, balance between supply anddemand of nutrients must be ensured by integrating the use of organic and inorganic fertilizerssuch as farm yard manure (FYM), green manure and synthetic fertilizers (Murali and Setty2000). These organic manures not only provide rich nutrient supplies, but they also improvethe physical, chemical, and biological characteristics of the soil, thereby increasing nutrientavailability. Apart from NPK, they also contain trace elements such as boron, copper, iron,sulphur, and zinc, as well as a decent number of growth stimulating chemicals. Organicmanuresprovide acontrolled supplyofnutrients byslowlyreleasingit, resultinginhigheryieldsandnutrient usageefficiency(Sharma2002). Afterwheatharvest,thereisenoughtimeinthebasmatirice-wheatcroppingsystem to incorporate organic fertilizers sources such as green manure (GM) and farmyard manure(FYM) into thesystem. Asaresult, in orderto sustain high crop production levels,itiscritical to enhance the effectiveness of chemical fertilizers through appropriate procedures andtheircombined usage withorganic manureand greenmanure (Meelu*etal*1994). Farmyardmanure(FYM)isasignificantcomponentofbulky organicmanures.TheFYMapplicationtosoilenhancesbiological,physicalandchemicalpropertiesofthesoil. Integration of organic sources into the nutrientmanagement system can reduce the dependence upon the chemical fertilizers and make theagricultureenvironmentallyand economicallyhealthier. Currently, a major emphasis is being made on planning the nutrient management strategy based on the entire cropping system rather than focusing on individual crops because succeeding crops are influenced by inputs applied in preceding crops (Ratanoo*et al.* 2022). The responses of the succeeding crops in a cropping system are influenced greatly by the inputs applied in preceding crops (Devi et al. 2015).

Keepingallthesepointsinview,thepresentinvestigationwas carried to study the residual effect of green manure, FYM and N fertilization on the succeedingwheatcrop

MATERIALANDMETHODS

The present study was carried out PunjabAgriculturalUniversity,RegionalResearch Station, Gurdaspur, during 2020-21 and 2021-22. Gurdaspur is situated at 75°40' E longitude and 32°04' N latitude with an averageheight of 241m above the sea level and is placed in the sub-mountainous region of Punjab. Insummerseason thetemperaturereachesupto 44^{o}C orevensometimescrosses it. June isfound as hottest month and January is the coldest one. The normal annual rainfall of thisregion is about 1325 mm, 80 percent of which is usually received during the south westernmonsoonseason andremainingduringwinter season.The meteorologicaldata recordedthatthemeanminimum weeklytemperature varied between 4.7ºC to 21.2ºC and3.9ºC to 23.6 ºC whereas mean maximumweekly temperature varied between 14.5ºC to 36.2ºC and 13.6 ºC to 37.7 ºC during cropgrowing periods of*rabi* 2020-21 and 2021-22 respectively (fig 1&2). Amount of rainfallreceived during the growing season was 118.2 mm and 263.5 mm during *rabi*2020-21 and 2021-22 respectively. Weekly hours of sunshine ranged from 1.1 to 7.6 and 0 to 7.9 duringthe crop seasons *rabi* 2020-21 and 2021-22 respectively. Rainfall was highest in 17th SMW (43.5 mm) and 2nd SMW (88.1mm) during *rabi* 2020-21 and 2021-22 respectively. The experiment was laid out in split-split plot design with three factors. Main plots contains three organic fertilizers treatments (greenmanuring, rice farmyardmanure@15tha^{-1}, and control: without green manuring and FYM), sub plot contains three nitrogen levels (100%recommendednitrogen, 75%recommendednitrogen and nonitrogen) and sub-sub plots contains three nitrogen application stage (recommended: equal dose at 3,6and9weeksafter sowing, 50%basal+25%at4weeksaftersowing+25%at9 weeksaftersowing and 50%basal+25%at3weeksaftersowing+25%at8 weeksaftersowing). Sunnhemp(*Crotalaria juncea*) as green manure crop wasincorporated in the soil after 45 days of its sowing. Farmyard manure @15tha^{-1} was applied totheplots as perthe treatments. The soil of experiment is normal in pH (7.7), low in organic carbon (0.40 %), low in available nitrogen (135.5 kgha^{-1}), high in available phosphorus (22.7 kgha^{-1}) and low in potassium (99.3 kgha^{-1}). The recommended dose of fertilizers was applied to wheat crop during both the years.Plant height and tillers of five randomly selected plants were recorded from each plot atharvest during both the years. Dry matter accumulation by the crop was noticed at harvest using plant destructive method thenexpressedasgm^{-2}. The effective tillers were recorded at harvest from one metre row length from twodifferentsites ineachplot.Thecountwasconvertedinto effectivetillersm^{-2}. Five spikes were randomly selected from each plot and their length was measured fromthe base to the tip of spike excluding awns. Length of five spikes was averaged and wasexpressedincm. The number of grainsper spike was counted from randomly selected ten ears atharvest andthe datawas expressed as numberof grainsperspikebytakingthe mean value. Thegrain and straw yieldwasrecordedinkilogramsperplot andconverted intoqha^{-1}. Harvest indexwascalculatedaspercentageofgrainyieldtobiological yield. Nitrogen content was determined byusingmodified Kjeldahl'smethodproposed byPiper(1966). To determine phosphorus content, vanado-molybdate phosphoricyellow color method in nitric acid system was used as outlined by Jackson (1967). Potassium content wasdetermined byusingLange's Flame Photometer(Jackson 1967).

RESULTS AND DISCUSSION

Growth characters

The data pertaining to plant height of wheat is presented in Table 1.The application of various organic fertilizers, nitrogen doses and its various split stages indirectseededbasmatiricedidnothaveasignificanteffectonplantheightofsucceedingwheatcrop during both the years of study.To evaluate the residual effect of different organic fertilizers, nitrogen levels andnitrogenapplicationstages,dataonperiodicnumber oftillers per m^{2}ofwheat recordedat harvestareprovidedinTable1.Among the organic fertilizers, FYM recorded the highest number of tillers m^{-2} which was at par with green manuring but significantly different from control during both the years. Thenitrogen doses and nitrogen application stages did not have significant effect on number oftillers on succeeding wheat crop during both the years. The higher number of tillers per m^{2} might be due to the addition of nutrients byorganic sources and their availability to the next crop due to slower decomposition rates. Thesignificant residual effect on tillers of wheat has also been reported by Jat and Singh (2019).They reported that highest number of tillers per meter row length was obtained inwheatwithapplicationofFYMandpressmudalongwithchemicalfertilizerstoprecedingrice crop. The data related to dry matter accumulation of wheat crop at various growth stages isdepicted in Table 1. There was significant effect ofvarious organic fertilizers on this growth parameter during both the years. FYM hadthe highest dry matter accumulation at these growth stages of the crop which was significantlysimilar to green manuring, but higher than control during both the years. FYM recorded 11% higher dry matter accumulationover control at harvest. The various nitrogen doses and nitrogen application stages had non-significant carryover effect on drymatter accumulationof wheat during both years. The residual effect of organic sources of nutrients was noticed in wheat and recordedhigher in dry matter accumulation of crop. The application of FYM and green manuring resulted in higheramount of nutrients in soil for plant nutrition and further being as organic source, continuousand slow release of nutrients enhanced cell elongation as well as various metabolic processesthatincreasedplantgrowthattributeswhichultimatelyhelpedinattainingthehighestsourcecapacityanddrymatteraccumulation.Significantresidualeffectoforganicinputsinsucceedingwheatcropinrice-wheatcroppingsystemhasalsobeenreportedbyLatare*etal*(2014).

Yieldattributes

The data (Table 2) revealed that various organic fertilizers had asignificant residual effect on the effective tillers m^{-2}during both the year of study. The application of FYM recorded thehighest number of effective tillers. It was significantly similar to green manuring but significantlyhigher than from control during both the year. Theeffectivetillerswereneithersignificantlyinfluencedbynitrogendosesnorbynitrogenapplicationstages.Jat and Singh (2019) also reported significant residual effect of organic manures oneffective tillers of wheat. They reported higher spikes per meter row length overcontrolwithapplicationof70%recommendeddoseoffertilizer+15%nitrogen by FYM + 15% nitrogen by poultry manure to previous rice crop. These results arealsocorroborated bythe findings ofKharuband Chander(2008).The data with respect to spike length of wheat crop is presented in Table 2. The various organic fertilizers, nitrogen doses andnitrogenapplicationstagesfailedtohaveanysignificant effectonspikelengthofwheat.An examination of data (Table 1) revealed that numbers of grains per spike were significantly affected by organic fertilizers.The application of FYM which wasonparwithgreen manuringbutsubstantiallygreaterthancontrola n d producedthemostgrainsperspike during both the years.Thenumberofgrainsperspikewasnotsignificantlyaffectedbyanynitrogendoseornitrogen applicationstage.The steady and liberal supply of adequate nutrients by the organic manures during thecrop growth period, thereby assisting in the fixation and translocation of more photosynthatesfrom source to sink and increasing the number of grains per spike. Similar results werereportedbyJatand Singh (2019).

Yield

The data pertaining to grain yield is presented in Table 3.Theapplication of organic fertilizers had a significant residual effect on the grain yield of wheat.ThehighestgrainyieldwasobtainedwithFYMwhichwasatparwithgreen manuringbutsignificantly different from control during both the years. FYM recorded higher 10.7% and 11.7 % grain yield during 2020-21 and 2021-22 over control respectively. The nitrogendoses and nitrogen application stages had non-significant effect on grain yield of wheat. Theorganicfertilizers,nitrogendosesandnitrogenapplicationstageshadnon-significantinteractioneffect. Theincreaseingrainyieldmightbeattributedtohighernumberofeffectivetillersand grains per panicle due to the residual effect of organic manures. Shah *et al* (2017) documented 15.8%higher wheat grain yield in Sesbania-incorporated plot than summer fallow. Similar resultshavealsobeenreported byHargilasand Sharma (2015). The data (Table 3) revealed that the straw yield of succeeding wheatcrop was significantly influenced by the organic fertilizers applied to the preceding basmatirice.TheapplicationofFYMproducedhighest strawyieldwhichwassignificantlysimilartogreen manuringbutdifferentthancontrol during both the years.Higher plant height, dry matter accumulation, and tillers are examples of increasedmorphological growth parameters that may be indirectly linked to an increase in straw yieldwith integrated nutrient treatments. These findings concur with those made by Jat and Singh(2019)and Dwivedi*etal*(2005). The data related to harvest index of the crop is depicted in Table 3. The harvestindex varied from 43.1 to 44.0% and 43.1 to 44.7% during 2020-21 and 2021-22 respectively. The various organic fertilizers, nitrogen doses and nitrogenapplicationstagesfailedtohaveanysubstantialimpactonthisindex.Similarly,theinteractionamongdifferenttreatmentswasalso non-significant.

Nutrients uptake

Nitrogen

Data on total nitrogen uptake by succeeding wheat crop are shown in Table 4. It was found that FYMapplication resulted in the highest total nitrogen uptake. It was comparable to green manuringbut significantly much higher than control during both the years of experimentation. The total nitrogen uptake was not impacted significantly bydiverse nitrogen dosages or nitrogen application phases during both the years. Organic fertilizers, nitrogen dosages,and nitrogen application stages had no significant interaction effect. Shah*etal*(2017)documentedthatresidual of organic treatments had a significant effect on nitrogen uptakein grainand straw bysucceedingwheat.

Phosphorus

Thetotal phosphorusuptake by succeeding wheat crop(Table 4)was also influenced by the organicfertilizersand the maximum value was recorded where FYM was applied @ 15 t ha^{-1}. Itwas significantly similar to green manuring but significantly higher than control during both the years. The nitrogen doses and nitrogen application failed to exhibitsignificant influence over total phosphorus uptake during both the years. No interaction effect among the varioustreatmentswas recorded. Higher grain yields, increased availability of phosphorus from organic sources, andthesolubilityeffectoforganicacidsformedduringtheirdecompositionmayallbecontributingfactorstoincreasedP-uptakeincrops.Shah*etal*(2017)documentedthatresidual of organic treatments had a significant effect on phosphorus uptakein grainand straw bysucceedingwheat.

Potassium

The information on potassium uptake by succeeding wheat crop is shown in Table 4.Thehighesttotal potassiumuptakebywheatgrainswasrecordedwithFYMapplication which was at par with GM but significantly different from control during both the years. Therewasnosignificanteffectonpotassiumuptakein case of nitrogen doses and nitrogen application stages during both the years.The interaction effect among varioustreatments was non-significant. Potassium uptake in wheat can be attributed to better yields, organic supplies, and thesolubilityactionoforganicacidsformedduringthebreakdownoforganicmaterials,whichled to more native potassium being released in the soil. Similar results have been reported bySharma*etal*(1995)and Rathore*etal*(1995).

References

Devi U, Singh K, Kumar S and Kumar P. 2015. Residual effect of nitrogen levels, organic manures and Azotobacter inoculation in multi-cut oats on succeeding sorghum crop. Forage Research 40: 254–56.

DwivediCP,TiwariON,NayakR,DwivediS,SinghAandSinhaSK(2005)EffectofgreenmanuresSesbaniaandVignaradiataandbiofertilizersonthesoilsustainability andcropproductivityinrice–wheatcroppingsystem.*PhysiolMolecBiolPlants* **11(1):** 141–51.

Gathala M K, Ladha J K, Saharawat Y S, Kumar V, Kumar V and Sharma P K (2011) Effectoftillageandcropestablishmentmethodsonphysicalpropertiesofamedium-texturedsoilundera seven-yearrice–wheatrotation.*Soil SciSocAmJ***75**:1851–62.

Hargilas and Sharma S N (2015) Residual, direct and cumulative effect of organic manuresand biofertilizers on yield, nutrient uptake, grain quality and economics of wheatunder organic farming of rice-wheat cropping system. *J Plant Develop Sci* **7(5):** 421-28.

Jackson M L (1967) Soil Chemical Analysis. Pp 234-46. Prentice Hall of India, PrivateLimited,NewDelhi.

Jat L K and Singh Y V (2019) Plant Growth and Yield as Affected by Application of OrganicInputs with Fertilizer in Rice Wheat Cropping Sequence. *Indian J Plant Soil* **6(1):**25-31.

Kharub A S and Chander S (2008) Effect of organic farming on yield, quality and soil fertilitystatusunderBansmatirice(*Oryzasativa*)-wheat(*Triticumaestivum*)croppingsystem. *IndianJ Agron***53(3):**172-77.

Latare A M, Omkar K, Singh S K and Archana G (2014) Direct and residual effect of sewagesludge on yield, heavy metals content and soil fertility under rice–wheat system. *EcolEngg***69:**17–24.

Meelu O P, Singh Y, Singh B, Khera T S and Kumar K (1994) Recycling of crop residue andgreen manuring for soil and crop productivity improvement in rice-wheat croppingsystems. In. Humpherey E, Murray E A, Clempett W S and Lewin L G (eds.). *ProcTempRice Achievem Potent***2:**605-13.

MuraliMKandSettyRA(2000)EffectsoflevelsofNPK,vermicompostandgrowth regulators(Triacontanol)ongrowthandyieldofscentedrice.*MysoreJAgriSci* **34**:335–39.

Paul J, Choudhary A K, Suri V K, Sharma A K, Kumar V and Shobhna (2014) Bio-resourcenutrient recycling and its relationship with bio-fertility indicators of soil health andnutrient dynamics in rice–wheat cropping system.*Comm Soil Sci Plant*

*Analysis***45**:912–24.

PiperCS(1966)*Soil andPlant Analysis*,International SciencePublisher,NewYork.

Ratanoo R, Walia S S, Saini K S and Dheri G S. 2022. Residual effects of chemical fertilizers, organic manure and biofertilizers applied to preceding gobhi sarson crop on summer mung bean (Vigna radiata L.). Legume Research 45: 860–65.

Rathore A L, Chipde S T and Pal A R (1995) Direct and residual effect of bio-organic andinorganicfertilizersinrice(*Oryzasativa*)-wheat(*Triticumaestivum*)croppingsystem.*IndianJ Agron***40:**14-19.

Shah I A, Sharma B C, Nandan B, Kumar R, Verma A and Banotra M (2017) Residual effectsof different soil organic amendments applied to aerobically grown rice (*Oryza sativa*)on succeeding wheat (*Triticum aestivum*) under basmati rice–wheat cropping system*IndianJ Agron***62(3):**321-25.

Sharma S N (2002) Nitrogen management in relation to wheat (*Triticum aestivum*) residuemanagement in rice(*Oryzasativa*). *IndianJAgric Sci***72:**449-52.

Sharma S N, Prasad R and Singh S (1995) The role of mungbean residue incorporation onproductivity and nitrogen uptake of a rice-wheat cropping system. *Biores Technol* **67:**171-75.

Singh R A, Singh J, Yadav D, Singh H K and Singh J (2012) Integrated nutrient managementinrice-wheatcroppingsystem. *IntJ Agric Sci***8**:523–26.

Table 1:Residual effect ofdifferentorganicfertilizers,nitrogenlevelsandnitrogenapplicationstagesindirectseededbasmatiriceongrowth charactersofsucceedingwheatcrop

Treatment	Plant height (cm)		Tillers (No. m^{-2})		Drymatter accumulation (g m^{-2})	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
Organicfertilizerapplied to preceding DSBR						
Greenmanuring	102.8	104.5	371.9	378.2	1021.5	1030.4
Farmyardmanure @15tha^{-1}	105.4	106.3	380.8	384.5	1045.2	1054.2
Control (Without green manuring and FYM)	100.6	102.1	359.0	362.4	967.3	986.8
CD(p=0.05)	NS	NS	11.6	9.6	24.0	27.3
Nitrogendosesapplied to preceding DSBR						
100%recommendednitrogen	104.8	106.0	373.7	377.4	1018.0	1030.2
50%recommended nitrogen	102.4	103.6	370.7	374.5	1011.7	1028.6
Control(withoutnitrogen)	101.5	103.3	367.3	373.2	1004.4	1012.6
CD(p=0.05)	NS	NS	NS	NS	NS	NS
Nitrogenapplicationstagein preceding DSBR						
Recommended(3,6and9weeksafter sowing)	103.7	104.3	372.5	376.0	1015.4	1025.6
50%basal+25%at4weeksaftersowing+25%at9 weeksaftersowing	102.8	105.4	370.0	375.1	1010.0	1029.5
50%basal+25%at3weeksaftersowing+25%at8 weeksaftersowing	102.3	103.2	369.3	374.0	1008.7	1016.3
CD(p=0.05)	NS	NS	NS	NS	NS	NS
Interaction	NS	NS	NS	NS	NS	NS

DSBR-Direct Seeded Basmati Rice

Table 2:Residual effect of differentorganicfertilizers,nitrogenlevelsandnitrogenapplicationstagesindirectseededbasmatiriceonyield attributing charactersofsucceedingwheatcrop

Treatment	**Effectivetillers (No. m^{-2})**		**Spike length (cm)**		**Grains (No. m^{-2})**	
	2020-21	**2021-22**	**2020-21**	**2021-22**	**2020-21**	**2021-22**
Organicfertilizerapplied to preceding DSBR						
Greenmanuring	322.0	333.6	9.60	9.8	46.7	53.5
Farmyardmanure @15tha^{-1}	329.0	345.0	9.95	10.0	48.6	54.9
Control (Without green manuring and FYM)	303.6	312.8	9.07	8.9	40.9	47.0
CD(p=0.05)	11.4	21.3	NS	NS	5.1	4.6
Nitrogendosesapplied to preceding DSBR						
100%recommendednitrogen	323.1	335.8	9.88	9.8	46.9	52.7
50%recommended nitrogen	317.7	330.4	9.42	9.7	45.6	52.4
Control(withoutnitrogen)	313.8	325.2	9.31	9.2	43.7	50.3
CD(p=0.05)	NS	NS	NS	NS	NS	NS
Nitrogenapplicationstagein preceding DSBR						
Recommended(3,6and9weeksafter sowing)	320.9	332.4	9.64	9.5	46.2	52.6
50%basal+25%at4weeksaftersowing+25%at9 weeksaftersowing	317.6	330.5	9.50	9.7	45.1	52.2
50%basal+25%at3weeksaftersowing+25%at8 weeksaftersowing	316.1	328.5	9.48	9.5	44.8	50.6
CD(p=0.05)	NS	NS	NS	NS	NS	NS
Interaction	NS	NS	NS	NS	NS	NS

DSBR-Direct Seeded Basmati Rice

Table 3::Residual effect of differentorganicfertilizers,nitrogenlevelsandnitrogenapplication stages in direct seeded basmati rice on grain yield, straw yieldandharvestindexofsucceedingwheatcrop

Treatment	Grain yield(qha^{-1})		Straw yield(qha^{-1})		Harvest index(%)	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
Organicfertilizerapplied to preceding DSBR						
Greenmanuring	46.8	52.6	61.0	65.6	43.5	44.5
Farmyardmanure @15tha^{-1}	48.6	53.2	63.5	68.2	44.0	44.7
Control (Without green manuring and FYM)	43.9	47.6	57.6	60.3	43.2	43.1
CD(p=0.05)	2.6	5.2	3.3	4.2	NS	NS
Nitrogendosesapplied to preceding DSBR						
100%recommendednitrogen	46.7	51.2	61.9	64.5	43.9	44.3
50%recommended nitrogen	46.5	52.7	60.4	65.2	43.8	44.7
Control(withoutnitrogen)	46.1	49.5	59.7	63.4	43.1	43.8
CD(p=0.05)	NS	NS	NS	NS	NS	NS
Nitrogenapplicationstagein preceding DSBR						
Recommended(3,6and9weeksafter sowing)	46.6	51.4	61.4	65.3	43.3	44.0
50%basal+25%at4weeksaftersowing+25%at9 weeksaftersowing	46.4	51.9	60.5	64.6	43.7	44.5
50%basal+25%at3weeksaftersowing+25%at8 weeksaftersowing	46.3	50.1	60.1	63.2	43.8	44.2
CD(p=0.05)	NS	NS	NS	NS	NS	NS
Interaction	NS	NS	NS	NS	NS	NS

DSBR-Direct Seeded Basmati Rice

Table 4:Residual effect of different organic fertilizers, nitrogen levels and nitrogenapplicationstages in direct seeded basmati rice ontotal N,P and K uptakeofwheat

Treatment	**N (kg ha^{-1})**		**P (kg ha^{-1})**		**K (kgha^{-1})**	
	2020-21	**2021-22**	**2020-21**	**2021-22**	**2020-21**	**2021-22**
Organicfertilizerapplied to preceding DSBR						
Greenmanuring	117.5	127.6	18.9	20.5	79.1	87.2
Farmyardmanure @15tha^{-1}	128.5	133.2	20.6	22.3	85.4	92.8
Control (Without green manuring and FYM)	97.8	102.5	15.6	15.9	68.5	71.3
CD(p=0.05)	6.1	11.6	1.4	3.9	8.9	11.2
Nitrogendosesapplied to preceding DSBR						
100%recommendednitrogen	117.1	125.0	18.8	21.4	79.4	85.4
50%recommended nitrogen	113.7	122.2	18.4	19.2	76.7	83.5
Control(withoutnitrogen)	112.6	119.1	17.9	18.1	74.9	82.4
CD(p=0.05)	NS	NS	NS	NS	NS	NS
Nitrogenapplicationstagein preceding DSBR						
Recommended(3,6and9weeksafter sowing)	116.3	124.3	18.5	20.9	78.7	84.6
50%basal+25%at4weeksaftersowing+25%at9 weeksaftersowing	114.2	122.0	18.3	19.2	77.1	84.2
50%basal+25%at3weeksaftersowing+25%at8 weeksaftersowing	113.3	120.0	18.3	18.6	76.4	82.5
CD(p=0.05)	NS	NS	NS	NS	NS	NS
Interactions	NS	NS	NS	NS	NS	NS

DSBR-Direct Seeded Basmati Rice

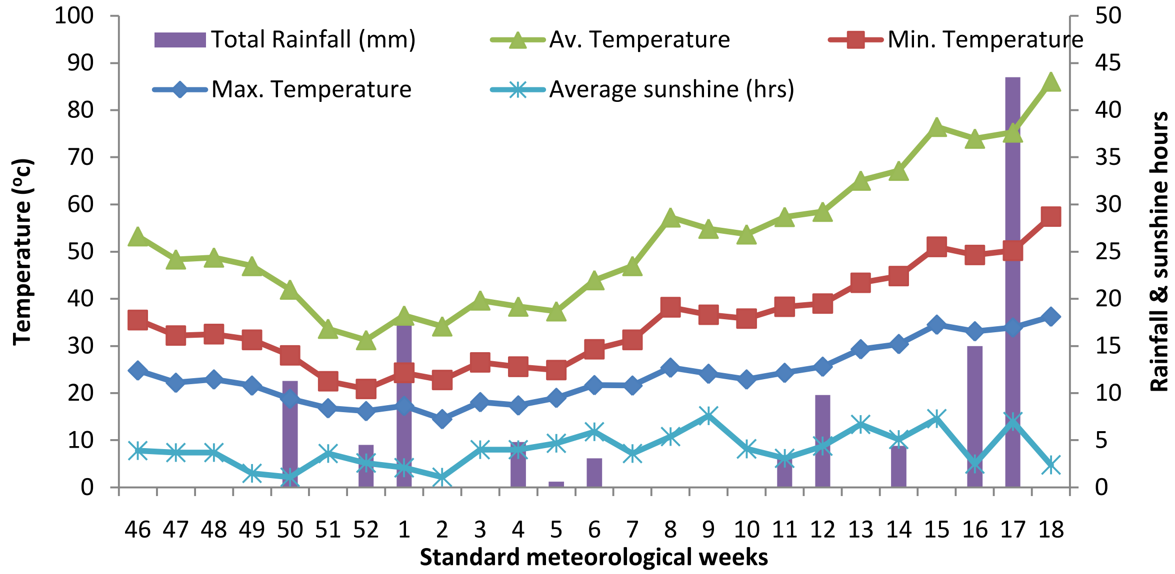

Fig.1.Weeklymeanmeteorologicaldata duringthe cropseason in*rabi*2020-21

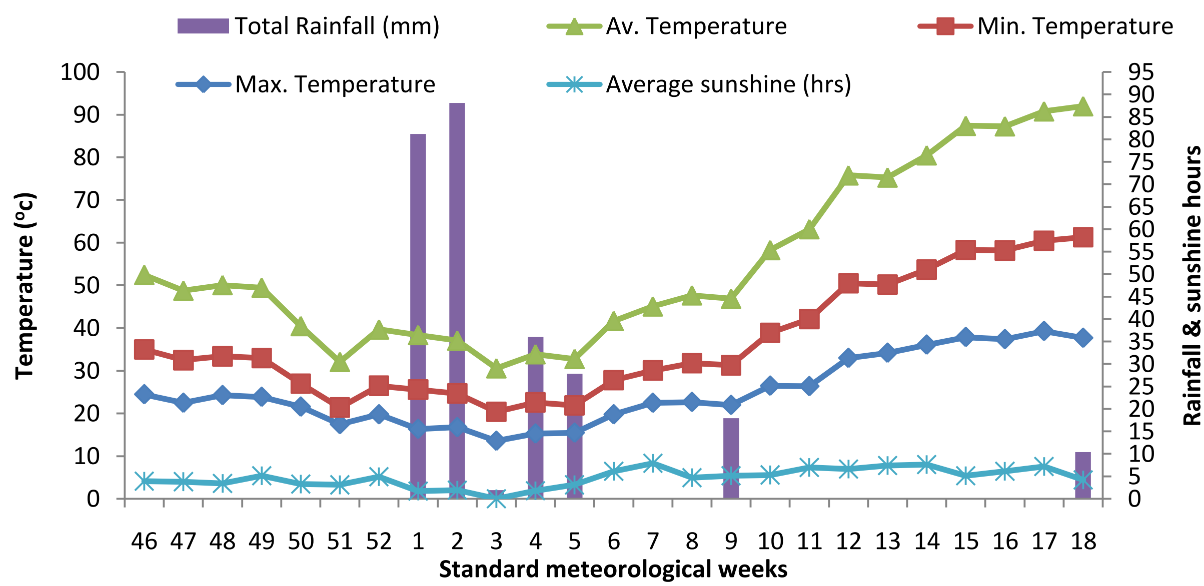

Fig.2.Weeklymeanmeteorologicaldata duringthe cropseason in*rabi*2021-22