Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(4): 255-258
Received: 05-05-2021
Accepted: 09-06-2021

Baljinder Singh
PhD Scholar, College of Agriculture, Guru Kashi University, Talwandi Sabo, Punjab, India

Balwinder Singh Dhillon
District Extension Scientist (Agronomy), Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India

Corresponding Author:
Balwinder Singh Dhillon
District Extension Scientist (Agronomy), Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India

Effect of moong bean as green manuring and residue incorporation on performance of wheat (*Triticum aestivum* L.)

Baljinder Singh and Balwinder Singh Dhillon

Abstract
The present investigation on "Effect of moong bean as green manuring and residue incorporation on growth, productivity of wheat" was conducted at Research Farm of Guru Kashi University, Talwandi Sabo, Bathinda during May 2019 to April 2021. Nine treatments were used in RCBD design with three replication in this experiment. The treatments were: T_1: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (residue incorporated), T_2: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (partial burning), T_3: Moong bean- Basmati rice-Wheat (residue incorporated), T_4: Moong bean- Basmati rice-Wheat (partial burning), T_5: Basmati rice (wheat residue incorporated)-Wheat (residue incorporated), T_6: Basmati rice (wheat residue incorporated)-Wheat (partial burning), T_7: Basmati rice-Wheat (residue incorporated), T_8: Basmati rice-Wheat (partial burning), T_9: Control (basmati rice-wheat).
It has been found that the loss of N was less in those treatments where green manuring along with incorporation of residues (T1, T2, T3 and T4). The treatments with crop residues incorporation (rice or wheat residue or both) + green manuring (T1 to T4) or crop residues (rice or wheat residue or both) (T5 to T8) or green manuring (T1) proved highly efficient in respect of economic return in of B: C ratio and total energy output when compared with control (Ti), however, integration of both the residues along with green manuring (T1) recorded the highest values of plant height, tiller density, dry weight, number of effective tiller m^{-1} row length, number of grains ear^{-1}, test weight, grain yield, straw yield and biological yield of wheat. Incorporation of residue was the best in terms of improved soil health, increased wheat yield, monetary return and B: C ratio.

Keywords: grain yield, moong bean, partial burning, residue and tiller density

Introduction
Green manuring is an age old practice as that of agriculture where in crops are incorporated into soil primarily as a soil amendment and as a source of plant nutrients for other crops, which lost importance as the use of mineral fertilizers became widespread. Green manures, also referred to as fertility building crops, may be broadly defined as crops grown for the benefit of the soil fertility.
They have been used in traditional agriculture for thousands of years but conventional farming systems largely rejected them as the use of fertilizers and pesticide became more common. Although they have many roles, they are still often under utilized by today's farmers. Use of green manure cover crops for soil fertility recoupment is among the most promising technologies to reverse the problems of land impoverishment for the poor rural people. When legumes are used as green manures, they fix atmospheric nitrogen and add a lot of organic matter to the soil. Organic matter when they decompose adds macro and micro-nutrients as well as improves the soil organic carbon content. Mandal and Pal (2009) [4] reported that green manuring increased root length, root volume, root dry weight (i.e. root characters) of rice compared with control. Residual effect of green manuring along with added nitrogen also significantly influenced all the root characters of wheat compared with control. Green manuring and its residual effect increased most of the yield components except test weight, grain yield and straw yield of rice and wheat compared with control. Sharma and Sharma (2005) [6] revealed that partial diversification of rice-wheat system by including mungbean during summer (May-June) in the rice-wheat system resulted in an increase in productivity and profitability. The rice-wheat-mungbean cropping system recorded the maximum harvest density index, multiple cropping index and simultaneous cropping index, indicating higher land use efficiency than the other rice-based cropping systems. In view of higher productivity and more profit obtained with rice-potato-mungbean, rice-clover, rice-rapeseed-mungbean and rice-wheat mungbean cropping systems as compared to the rice-wheat cropping system, the

diversification of this cropping system is recommended for sustainable production.

Material methods

The present investigation was conducted during two consecutive years (i. e. 2019-20 and 2020-21) at research farm of University College of Agriculture, Guru Kashi University, Talwandi Sabo. Talwandi Sabo is located at 29°-59'N latitude and 75°-4'E longitude and altitude of 213 meters above sea level. This tract is characterized by semi arid zone, where both winters and summers extreme. A maximum temperature of about 40-41.9°C is not uncommon during summer, while freezing temperature accompanied by frost occurrence may be witnessed in the months of January and February. The experiment was laid out in a Randomized complete block design with nine treatments *viz*; T_1: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (residue incorporated), T_2: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (partial burning), T_3: Moong bean- Basmati rice-Wheat (residue incorporated), T_4: Moong bean- Basmati rice-Wheat (partial burning), T_5: Basmati rice (wheat residue incorporated)-Wheat (residue incorporated), T_6: Basmati rice (wheat residue incorporated)-Wheat (partial burning), T_7: Basmati rice-Wheat (residue incorporated), T_8: Basmati rice-Wheat (partial burning), T_9: Control (basmati rice-wheat). The experimental data was recorded on plant growth and development (Plant height (cm), effective tillers, panicle length, number of grains/panicle, yield attributes and yield of wheat during both the years of study.

Result and discussion

Growth attributing characters of wheat

Plant height: Plant height of wheat was taken at four growth stages at 30, 60. 90 DAT and at maturity. Significant effect of the treatments was noticed in the both years. From the data (Table 1), it has been observed that plant height was significantly influenced by the treatments and higher plant height was recorded from the treatment receiving residue incorporation (rice or wheat or both or partial burning) followed by green manuring (T_1, T_2 and T_4) as compared to treatments comprising residue incorporation (T_5, T_6, T_7 and T_8) and control (T_9). However, among these treatments T_1 recorded the highest plant height both years, which is at par with treatments T_2 and T_4 respectively and significantly higher than the other treatments at 30 DAT and same trend is with 60, and 90 DAT. The treatment T_1 is significantly at par with T_2, T_3 and T_4 and significantly higher than the treatments T_5, T_6, T_7, T_8 and T_9 during both years at 60 DAT. At the time of maturity T_9 has been found to be significantly higher than the all other treatments. However, treatments T_2 to T_8 is at par during first year (2019). During second year (2020) T_1 is significantly higher than all other treatments and treatments T_2, T_3, T_4 was found statistically at par and higher with the control (T_9).

The findings are in accordance with Mukherjee and Singh (2001) [5] who reported that the significant effect of green manuring with Sesbania on plant height at 50 and 70 DAP and harvest, but plant heights in all the residue management treatments (residue removal, residue burning, residue incorporation, green manuring + residue removal and green manuring + residue incorporation) were statistically at par with each other at all stages.

Periodic tiller density: Significant influences of treatments on periodic tiller density have been observed in both the years Table 2. It has been observed that the treatments T_1 to T_6 were statistically at par and significantly superior to T_9, in first year (2019). However in second year (2020) T_1 have been recorded with the highest tiller density which have been found to be statistically at par with treatments T_2 to T_6 and significantly higher than T_9 and T_8 at 30 DAT. However treatments T_1 to T_6 have been found to be significantly higher and at par than all other treatments T_7, T_8 and T_9 respectively at 120 DAS. The findings are in accordance with Mandal and Pal (2009) [4] who reported that green manuring

Table 1: Effect of green manuring and residue incorporation on plant height of wheat

Treatments	Plant height (cm)							
	30 DAT		60 DAT		90 DAT		At maturity	
	2019	2020	2019	2020	2019	2020	2019	2020
T1	22.5	26.8	41.8	43.8	101.5	103.5	110.0	111.0
T2	22.0	26.1	41.2	43.2	100.5	102.5	103.0	106.0
T3	20.1	24.1	40.0	42.0	101.1	103.1	106.5	106.0
T4	21.1	25.0	41.3	43.3	101.4	103.4	105.5	108.0
T5	16.6	20.4	39.0	41.0	101.0	103.9	104.5	103.0
T6	14.6	19.6	38.7	38.3	102.4	104.4	102.5	104.0
T7	11.0	15.1	38.1	38.1	99.5	102.5	102.0	103.0
T8	10.1	14.1	38.4	39.4	99.0	100.5	101.0	104.0
T9	10.9	9.5	37.0	34.0	99.5	99.5	102.5	102.0
LSD	1.0	1.0	1.9	4.4	1.9	2.6	4.2	0.0

T_1: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (residue incorporated), T_2: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (partial burning), T_3: Moong bean- Basmati rice-Wheat (residue incorporated), T_4: Moong bean- Basmati rice-Wheat (partial burning), T_5: Basmati rice (wheat residue incorporated)-Wheat (residue incorporated), T_6: Basmati rice (wheat residue incorporated)-Wheat (partial burning), T_7: Basmati rice-Wheat (residue incorporated), T_8: Basmati rice-Wheat (partial burning), T_9: Control (basmati rice-wheat).

Table 2: Effect of green manuring and residue incorporation on periodic tiller density of wheat

Treatments	Periodic tiller density/m row length			
	60DAT		120DAT	
	2019	2020	2019	2020
T1	135.7	137.6	136.3	139.5
T2	133.5	136.0	135.0	138.0
T3	130.7	136.0	132.0	133.0

T4	130.0	133.5	133.0	136.0
T5	130.1	132.5	129.3	132.0
T6	130.3	130.5	130.3	130.0
T7	121.7	122.5	121.3	130.5
T8	104.0	103.5	125.0	125.5
T9	102.0	101.0	122.3	122.5
LSD	7.0	6.8	5.1	4.1

T_1: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (residue incorporated), T_2: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (partial burning), T_3: Moong bean- Basmati rice-Wheat (residue incorporated), T_4: Moong bean- Basmati rice-Wheat (partial burning), T_5: Basmati rice (wheat residue incorporated)-Wheat (residue incorporated), T_6: Basmati rice (wheat residue incorporated)-Wheat (partial burning), T_7: Basmati rice-Wheat (residue incorporated), T_8: Basmati rice-Wheat (partial burning), T_9: Control (basmati rice-wheat).

Table 3: Effect of green manuring and residue incorporation on yield attributing characteristics of wheat

Treatments	Number of effective tillers/m row length		Ear length (cm)		No. of grains/ear		1000-grain weight (g)	
	2019	2020	2019	2020	2019	2020	2019	2020
T1	120.0	124.0	8.9	9.0	43.6	44.0	40.2	41.1
T2	118.0	119.0	8.6	8.7	42.8	43.6	40.2	40.5
T3	113.0	115.0	8.6	8.6	43.2	44.0	40.2	40.6
T4	115.0	120.0	8.6	8.6	42.3	43.5	39.8	40.1
T5	119.0	119.0	8.4	8.4	40.0	42.0	39.6	39.8
T6	116.0	117.0	8.4	8.4	41.8	42.4	39.5	39.8
T7	118.0	118.0	8.4	8.4	41.0	41.2	39.4	39.7
T8	114.0	116.0	8.3	8.3	40.0	40.0	39.5	39.5
T9	112.0	110.0	8.3	8.1	38.0	37.0	38.8	37.5
LSD	NS	1.1	0	0.07	1.11	1.12	NS	0.81

T_1: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (residue incorporated), T_2: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (partial burning), T_3: Moong bean- Basmati rice-Wheat (residue incorporated), T_4: Moong bean- Basmati rice-Wheat (partial burning), T_5: Basmati rice (wheat residue incorporated)-Wheat (residue incorporated), T_6: Basmati rice (wheat residue incorporated)-Wheat (partial burning), T_7: Basmati rice-Wheat (residue incorporated), T_8: Basmati rice-Wheat (partial burning), T_9: Control (basmati rice-wheat)

Increased root length, root volume, root dry weight (i.e. root characters) compared with control

Yield attributing characters of wheat

Effective tiller/ m row length: The data for effective tiller/ m row length have been presented in Table 3. Significant influences of treatments on effective tillering have been observed in both the years. It has been observed that the first year (2019) treatment were found non significantly different to each other and statistically at par with each other. However second year (2020) treatments T_1 was found to be significantly superior and statistically at par with treatments T_2 to T_8 which was higher than T_9. The findings are in accordance with Mandal and Pal (2009) [4] who reported that green manuring increased root length, root volume, root dry weight (i.e. root characters) compared with control.

Ear length: The data for ear length have been presented in Table 3. Ear length during first year (2019) with treatment T_1 found to be significantly higher than all other treatments T_2, T_3, T_4, T_5, T_6, T_7, and T_8 which was statistically at par but higher than T_9. However during second year (2020) the panical length with treatment T_1 found significantly higher than all other treatments T_2 to T_9. The observation is substantiated with the findings of Arshadullah *et al.* (2012) [1] who noted maximum panicle length in treatment receiving straw incorporation @ 5 t ha'1 along with 90 kg N ha^{-1}.

Number of grains ear^{-1}: The data for Number of grains ear^{-1} have been presented in Table 4.3. Number of grains ear^{-1} was statistically at par and superior with treatments T_1 to T_4 during first year (2019) than all other treatments T_5 to T_9. However during second year (2020) T_1 was significantly higher no. of grains ear^{-1} than all other treatments T_2 to T_8. Treatments T_2 to T_8 is significantly at par but superior to T_9. Higher length of ear head might have attributed to more grains per ear head in this treatment.

1000-grain weight: The data for 1000-grain weight have been presented in Table 3. 1000 grain weight during first year (2019) found to be non significantly different however during second year (2020) T_1, T_2, T_3 and T_4 have significantly higher test weight than all other treatments T_5 to T_8 which was found to be statistically at par and superior to T_9. Microbial activity would have increased due to residue decomposition helped the crop to attain good vigour and to produce healthy seeds.

Grain yield, straw yield, biological yield and harvest index of wheat

Grain yield: Grain yield was significantly influenced by the treatments in both the years as revealed by the data presented in the Table 4. However the influence was more pronounced in the second year except for the treatments T_9 and T_8 which might be due to better nutrient availability in the plots receiving treatments T_1 to T_3 as a result of the effect of crop residues incorporation (rice or wheat or both) and green manuring. Fertility level in the plots receiving treatments T_9 and T_8 might have depleted over time because of non incorporation/non management of organic sources of nutrients. In the first year (2019), treatments T_5 to T_8 have been found to be statistically at par but significantly greater than control T_9 as most of the yield attributing characters followed the same trend as depicted in the above tables. However, T_1 recorded the highest yield (45q ha^{-1}) which was found to be at par with treatments T_2 and T_3 treatments but significantly greater than T_9, T_8, T_7, T_6 and T_5 in the second year (2020).

The findings are in agreement with Sharma and Sharma (2005) [6] found that retention or incorporation of rice, wheat or both crop residues increased soil organic C by 19-32%

(absolute increases of 0.06-0.1% organic C) in the top 0-15cm soil layer after 2 years (four crops) in comparison with both the initial soil organic C and 2 years of burning the residues of both crops.

Straw yield: Straw yield was significantly influenced in both the years but the influence was more pronounced in second year (2020) especially in the treatments where crop residues (rice

Table 4: Effect of green manuring and residue incorporation on grain yield, straw yield, biological yield and harvest index (%) of wheat

Treatments	Grain yield (q/ha)		Straw yield (q/ha)		Biological yield (q/ha)		Harvest index (%)	
	2019	2020	2019	2020	2019	2020	2019	2020
T1	43.0	45.0	86.3	90.6	131.3	135.6	34.0	33.2
T2	41.3	45.5	82.5	84.5	123.8	130.0	33.3	34.8
T3	41.0	45.5	78.5	85.3	119.5	131.0	34.3	34.7
T4	42.0	42.0	78.5	71.8	120.5	113.8	34.8	36.9
T5	41.5	42.5	68.0	78.3	109.5	120.8	37.8	35.2
T6	40.0	40.0	69.0	75.3	109.0	115.3	36.7	34.7
T7	40.3	40.3	65.0	75.0	105.3	115.3	38.2	34.9
T8	41.0	39.0	66.0	74.5	107.0	113.5	38.3	34.3
T9	33.0	38.0	65.2	72.5	98.2	110.5	33.6	34.3
LSD	0.8	0.9	8.0	9.9	10.3	11.0	NS	NS

T_1: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (residue incorporated), T_2: Moong bean (Wheat residue incorporated)-Basmati Rice-Wheat (partial burning), T_3: Moong bean- Basmati rice-Wheat (residue incorporated), T_4: Moong bean- Basmati rice-Wheat (partial burning), T_5: Basmati rice (wheat residue incorporated)-Wheat (residue incorporated), T_6: Basmati rice (wheat residue incorporated)-Wheat (partial burning), T_7: Basmati rice-Wheat (residue incorporated), T_8: Basmati rice-Wheat (partial burning), T_9: Control (basmati rice-wheat)

or wheat or both) were incorporated along with or without green manuring (T_1 to T_4) as depicted in Table 4.4 which might be due to enrichment of soil fertility because of crop residue incorporation and green manuring. From the data of both the years it also has been observed the significant effect of the treatments on straw yield. However, T_9 have been observed with the highest mean straw yield (86.3 q ha^{-1}) though there was no significant difference among the treatments from T_5 to T_9. The findings were in accordance with and Jai *et al.* (2014) [3] found that incorporation of crop residue (CRI) with or without *Sesbania* green manure (SGM) were observed significantly greatest straw yields in rice.

Biological yield: Biological yield was significantly influenced by the treatments in both the years as revealed by the data presented in the Table 4.4. Biological yield followed the same trend as that of grain yield/straw yield and recorded higher values in the second year. The significantly higher biological yield was received from treatment T_1 which were found to be statistically at par with T_2 and T_3 and significantly higher than control.

Harvest index (%): Harvest index was non significantly influenced during both the years of study.

Conclusion

It may be concluded that incorporation of rice and wheat residues in combination with green manuring increased the plant height, number of tillers, number of effective tillers, dry matter accumulation, panicle length, number of grains per panicle, test weight, grain yield, straw yield, biological yield. Improves nutrient uptake by both rice and wheat crops, in sustaining soil fertility by improving soil physical properties, available nutrients etc.

References

1. Arshadullah M, Arshad A, Syed Ishtiaq H, Imdad AM, Badar-uz-Zaman. Integrated effects of wheat residue and phosphorus application on rice productivity and soil health under salt affected soils. Pak. J Sci. Ind. Res. Ser. B: biol. Sci 2012;58(3):117-121.
2. Das K, Medhi DN, Guha B, Baruah BK. Direct and residual effects of recycling of crop residues along with chemical fertilizers in rice-wheat cropping system. Annals of Agricultural Research 2002;23(3):415-418.
3. Jai Paul, Choudhary AK, Sur VK, Sharma AK, Vinod Kumar, Shobhna. Bioresource nutrient recycling and its relationship with biofertility indicators of soil health and nutrient dynamics in rice-wheat cropping system. Communications in Soil Science and Plant Analysis 2014;45(7):912-924.
4. Mandal A, Pal AK. Growth of roots and yield as influenced by green manuring in rice-wheat cropping system. Agricultural Science Digest 2009;29(1):32-35.
5. Mukherjee A, Singh Y. Influence of crop residue management and green manuring on growth attributes of transplanted rice (*Oryza sativa* L.) Environment and Ecology 2001;19(4):833-835.
6. Sharma SK, Sharma SN. Effect of crop diversification of rice-wheat cropping system on productivity and profitability. Journal of Sustainable Agriculture 2005;26(1):39-48.