International Journal of Environment and Climate Change

Volume 13, Issue 11, Page 3838-3845, 2023; Article no.IJECC.109870
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Performance of Seed Rate on Wheat Crop (*Triticum aestivum* L.) under Late Sown Condition

Harivansh Singh [a*], Anil Kumar Singh [b++], Shivam Chaubey [a] and Vivek Kumar Singh [a]

[a] Department of Agronomy, T. D. P.G. College, Jaunpur-222002, U.P., India.
[b] M.G.P.G. College, Gorakhpur, U.P., India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i113563

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/109870

Original Research Article

Received: 22/09/2023
Accepted: 27/11/2023
Published: 28/11/2023

ABSTRACT

A study was conducted to investigate the "Performance of seed rate on wheat crop (*Triticum aestivum* L.) Under late Sown Condition." This experiment was carried out during the Rabi seasons of 2018-2019 and 2019-2 020 at the Pili-Kothi Student Research Farm and in the Laboratory Department of Agronomy at T.D.P.G. College Jaunpur. Increasing seed rates demonstrated a significant influence on various growth parameters, including initial plant population, shoot numbers, plant height, and dry matter production, with the highest values consistently observed at 140 kg/ha. In terms of yield-contributing characteristics, the 140 kg/ha seed rate led to increased spike counts, longer spikes, more grains per spike, and heavier grains. Yield significantly favored the 140 kg/ha rate, averaging 4.25-4.21 Mg/ha, surpassing the 120 kg/ha rate (4.08-4.07 Mg/ha) and markedly

[++] *Principal;*
**Corresponding author: E-mail: harrysinghvs@gmail.com;*

exceeding the 100 kg/ha rate (3.85-3.84 Mg/ha). The straw and biological yields further echoed this trend, cementing the prominence of the 140 kg/ha seed rate in augmenting late-sown wheat productivity.

Keywords: Plant population; spikelets; seed rate; prominence; surpassing; growth etc.

1. INTRODUCTION

The cultivation of Wheat (*Triticum aestivum* L.) stands as an essential cornerstone in the global agricultural landscape, recognized as a pivotal cereal crop within the Poaceae family [1]. Its significance transcends borders, serving as a vital component of numerous nations' food security systems. India, contributing approximately 13% of the world's total wheat production, exemplifies its crucial role. This grain's adaptability across diverse agro-climatic conditions underscores its importance. In India, Wheat claims the second position in crop cultivation, inhabiting approximately 31.36 million hectares and yielding 107.86 million tonnes with a productivity rate of 3.44 tonnes per hectare (World Agricultural Production {USDA}, 2020-21).

Within India, the Northern states spearhead production, with Uttar Pradesh leading in area coverage (9.50 million hectares) and total production (30.19 million tonnes). However, despite this prominence, the state grapples with comparatively lower productivity (3432 Kg ha^{-1}) in contrast to regions like Punjab and Haryana. Factors contributing to this disparity span atmospheric, edaphic and agronomic realms ranging from inadequate fertilizer application, delayed sowing, improper variety selection, to insufficient seed rates and irrigation. Wheat, an annual grass boasting height between 50 to 125 cm, culminates in clusters of kernels ensconced within bristly spikes [1]. Its cultivation, spanning millennia, has evolved its grain into a highly nutritious staple, pivotal in global agriculture alongside corn and rice. Wheat's versatility extends across varied applications, from bread and biscuits to feeds and confectionery, underscoring its multifaceted utility. Rich in nutrients, wheat encapsulates 12.6 grams of protein, 1.5 grams of fat, 71 grams of carbohydrates, 12.2 grams of dietary fiber and 3.2 mg of iron, a significant fraction being starch [2]. Previous research suggests that altering seed rates can significantly impact plant population, biomass accumulation, and yield parameters in wheat [3,4]. However, limited exploration exists concerning seed rates' efficacy specifically under late-sown scenarios. This investigation aims to fill this gap by evaluating the response of late-sown wheat to different seed rates, providing insights crucial for optimizing agricultural practices in challenging growing conditions.

2. MATERIALS AND METHODS

The research trial for the present investigation spanned two consecutive Rabi seasons, namely 2018-2019 and 2019-2020, and was conducted at both the Pili-Kothi Student Research Farm and the Laboratory Department of Agronomy at T.D.P.G. College Jaunpur. The research plot is located in close proximity to the institution, approximately 5 km away. It is situated at an elevation of 83 meters above sea level, with coordinates at latitude 25°43'58" N and longitude 82°41'10" E. The selection of plot locations took into consideration homogeneous fertility, accessibility to irrigation channels, and a readily available source of irrigation.

The study consisted of a total of 12 treatment combinations, comprising three seed rate options and four nutrient management treatments. The experimental design employed was a factorial randomized block design. The three seed rate treatments (S_1: 100 kg ha^{-1}, S_2: 120 kg ha^{-1}, S_3: 140 kg ha^{-1}) were combined with four nutrient management treatments (F_1: 100% RDF, F_2: 125% RDF, F_3: 75% RDF + 25% N through FYM, F_4: 75% RDF + N through Vermicompost), resulting in a total of 12 treatment combinations, each replicated three times. The experimental field was divided into 36 plots, with each gross plot measuring 3.6 x 5.0 square meters and a net plot size of 3.6 x 4.5 square meters. Row-to-row spacing was consistently maintained at 18 cm

3. RESULTS AND DISCUSSION

3.1 Initial Plant Population

The data pertaining to initial plant population per square metre as influenced by different treatments have been summarized in Table 1.

The data reveals that the different seed rate have significant influence on the initial plant population per square metre during both the year. Initial plant population was significantly increased with the higher level of seed rate during both the years. The higher number of plants (272.05 during 2018-19 and 277.05 during 2019-20) were found under 140 kg seed ha^{-1} when compare with seed rate of 120 kg ha^{-1}. Whereas, significantly minimum initial plant population was recorded under 100 kg seed ha^{-1} treatment during both the years. The results confirm with the findings of Chaudhary et. al. [5]

3.2 Number of Shoot (m^{-2})

The data on the number of shoots as affected by different treatments was recorded at 30, 60, 90 DAS and at maturity are presented in Table 2. In general, the tiller production increased up to 60 days after sowing and thereafter it declined due to mortality of younger shoots irrespective of the treatment.

The perusal of data given in Table 2. indicate that, Seed rate increased the number of shoot m^{-2} significantly up to (S_3) 140 kg seed ha^{-1} which was significantly superior the application of (S_2) 120 kg seed ha^{-1} and (S_1) 100 kg ha^{-1} seed at all stages of crop growth. The lower shoot m^{-2} was recorded with the sowing of 100 kg seed ha^{-1} at all the stages of crop growth, during both the years. The result confirms the findings of Singh [6].

3.3 Plant Height (cm)

Data on plant height as affect by seed rates are presented in Table 3. the critical scruting of plant height datas reveals that generally plant height remained higher during second year (2019-2020) in comparison to first year (2018-2019). In general, plant height increased as the growth progressed up to harvest. However, the rate of increase in plant height was minimum between 90 DAS and at harvest stage. A perusal of data reveals that plant height differed amongest seed rate. Sowing of crop with 140 Kg seed ha^{-1} (S_3) recorded higher plant height at 60 & 90 DAS but was at par with other seed rate at all growth stages. Whereas, S_1 recorded significantly minimum plant height at all the growth stages, except 30 DAS during both the years of study. The results confirm with the findings of Chaudhary et. al. [5]

Table 1. Initial plant population as influenced by seed rate

Treatment	Initial plant population at 20 DAS (m^{-2})	
	(2018-19)	(2019-20)
Seed rate (kg ha^{-1})		
100 kg ha^{-1}	207.22	208.88
120 kg ha^{-1}	252.33	255.66
140 kg ha^{-1}	272.05	277.05
SEm±	6.66	7.46
C.D. (P=0.05)	19.54	21.87
Interaction	NS	N S

Table 2. Number of shoots (m^{-2}) as influenced by seed rate and nutrient supply system at different stages of crop growth

Treatment	Number of shoots (m^{-2})							
	30 DAS		60 DAS		90 DAS		At harvest	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Seed rate (kg ha^{-1})								
100 kg ha^{-1}	426.47	428.13	612.29	612.36	399.55	399.60	365.76	366.00
120 kg ha^{-1}	477.06	480.39	586.40	586.47	412.84	412.91	382.99	383.08
140 kg ha^{-1}	529.80	534.80	755.38	755.69	463.24	463.27	428.26	428.37
SEm±	7.22	7.44	9.50	9.51	6.43	6.43	5.67	5.68
C.D. (P=0.05)	21.17	21.63	27.87	27.89	18.85	18.86	16.64	16.65
Interaction	NS	NS	NS	NS	NS	NS	NS	NS

Table 3. Plant height (cm) of wheat as influenced by seed rate and nutrient supply system at different growth stages

Treatment	Plant height (cm)							
	30 DAS		60 DAS		90 DAS		At harvest	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Seed rate (kg ha^{-1})								
100 kg ha^{-1}	17.33	17.50	49.94	50.18	87.13	87.30	92.65	90.00
120 kg ha^{-1}	17.61	17.77	48.47	49.22	87.63	88.47	93.00	92.14
140 kg ha^{-1}	17.09	17.30	50.34	51.41	88.76	89.46	92.89	94.16
SEm±	0.36	0.35	0.76	0.85	1.33	1.18	1.31	1.34
C.D. (P=0.05)	1.06	1.02	2.23	2.49	3.90	3.46	3.86	3.94
Interaction	NS	NS	NS	NS	NS	NS	NS	NS

3.4 Dry Matter Accumulation (g m^{-2})

Data pertaining to dry matter accumulation gm^{-2} at different growth stages as affected by various treatments have been presented in Table 4.

Perusal of data reveals that significantly higher dry matter was recorded in S_3 than S_1, which was statistically significant S_2 at all crop growth stages during both the years. However, S_1 recorded significantly lowest dry matter at all the growth stages during both the years of investigation.

3.5 Leaf Area Index

The summary of data on leaf area index at different growth stages as affected by seed rate have been presented in Table 5. Critical appraisal of data showed that leaf area index increased up to 90 days. 140 kg seed rate recorded significantly higher leaf area index than 100 kg seed rate, but remained on par with 120 kg seed rate at all the growth stages. Whereas, 100 kg seed rate recorded minimum leaf area index at all the growth stages during both the years of investigation. The results are in agreement with the findings of kumar et. al [7].

3.6 Days Taken to 50 % Heading

The 50% heading as affected by different seed rates are presented in Table 6. The data presented in table also indicated that the higher value of 50% heading (68.178 during 2018-19 and 68.257 during 2019-20) was obtained with the sowing of (S_3) 140 kg ha^{-1} seed which was at par with the sowing of (S_2)120 kg ha^{-1} seed. The lowest 50% heading S_1 (67.216 during 2018-19 and 67.343 during 2019-20) was found with the application of 100 kg ha^{-1} seed.

3.7 Effect of Seed Rate on Yield Attributing Character

3.7.1 Number of spike (numbers/m^2)

The data presented in Table 7 indicated that the highest value of number of spike (417.40 during 2018-19 and 417.50 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was significantly superior over lower seed rate doses. The lowest number of spike (358.44 during 2018-19 and 358.50 during 2019-20) was found with 100 kg ha^{-1} seed) and remain at par with 120 kg seed ha^{-1} but significantly inferior than 140 kg seed ha^{-1} in respect to numbers of spike per unit area during both the years. The results confirm with the findings of Laghari et. al. [8]

3.7.2 Length of spike (cm)

The data presented in Table 7 also indicated that the higher value of spikes length (9.50 during 2018-19 and 9.58 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of (S_2)120 kg ha^{-1} seed. The lowest length of spike (8.99 during 2018-19 and 9.05 during 2019-20) was found with 100 kg ha^{-1} seed which remain at par with 120 kg seed ha^{-1} during both the years. The results confirm with the findings of Kumar et al [7]

3.7.3 Number of Grains Spike^{-1}

The data presented in Table 7 also indicated that the higher number of grain spike^{-1} (40.96 during 2018-19 and 40.89 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of (S_2)120 kg ha^{-1} seed. The lowest number of grain spike^{-1} (38.27 during 2018-19 and 38.33 during 2019-20) was found with (S_1) 100 kg ha^{-1} seed with was statistically similar with 120 kg ha^{-1} seed but inferior than 140 kg ha^{-1} seed during both the years. The results confirm with the findings of Laghari et. al. [8]

Table 4. Dry matter accumulation as influenced by seed rate on wheat crop

Treatment	Dry matter accumulation (g m^{-2})							
	30 DAS		60 DAS		90 DAS		At harvest	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Seed rate (kg ha^{-1})								
100 kg ha^{-1}	68.30	71.82	477.05	476.00	792.98	784.28	933.35	930.59
120 kg ha^{-1}	75.70	75.70	503.43	500.85	823.64	817.70	977.65	975.29
140 kg ha^{-1}	78.63	78.63	510.38	509.15	860.65	856.38	1109.95	1108.34
SEm±	1.12	1.09	7.49	7.36	12.45	11.82	15.21	14.90
C.D. (P=0.05)	3.28	3.19	21.98	21.66	36.53	34.65	44.60	43.70
Interaction	NS	NS	NS	NS	NS	NS	NS	NS

Table 5. Leaf area index (LAI) as influenced by seed rate at different stages on wheat crop

Treatment	Leaf area index (LAI)					
	30 DAS		60 DAS		90 DAS	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Seed rate (kg ha^{-1})						
100 kg ha^{-1}	1.11	1.17	3.29	3.35	4.21	4.21
120 kg ha^{-1}	1.17	1.22	3.64	3.70	4.36	4.38
140 kg ha^{-1}	1.23	1.26	3.70	3.75	4.80	4.51
SEm±	0.02	0.02	0.05	0.05	0.17	0.06
C.D. (P=0.05)	0.05	0.04	0.16	0.15	0.51	0.18
Interaction	NS	NS	NS	NS	NS	NS

Table 6. Days taken to 50 % heading

Treatment	Days taken to 50 % heading	
	(2018-19)	(2019-20)
Seed rate (kg ha^{-1})		
100 kg ha^{-1}	67.216	67.343
120 kg ha^{-1}	67.230	67.692
140 kg ha^{-1}	68.178	68.257
SEm±	0.088	0.145
C.D. (P=0.05)	0.261	0.429
Interaction	NS	NS

Table 7. Number of spike m^{-2}, length of spike and number of grain $spike^{-1}$ as influenced by seed rate and nutrient supply system on wheat crop

Treatment	Number of spike/m^2		Length of spike (cm)		Grain $spike^{-1}$	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Seed rate (kg ha^{-1})						
100 kg ha^{-1}	358.44	358.50	8.99	9.05	38.27	38.33
120 kg ha^{-1}	376.16	376.23	9.29	9.28	40.05	40.10
140 kg ha^{-1}	417.40	417.50	9.50	9.58	40.96	40.89
SEm±	6.30	6.29	0.14	0.15	0.60	0.63
C.D. (P=0.05)	18.48	18.46	0.41	0.44	1.76	1.84
Interaction	NS	NS	NS	NS	NS	NS

3.7.4 Number of fertile spikelets spike^{-1}

The data presented in the Table 8 also indicated that the higher number of fertile spikelets spike^{-1} (19.54 during 2018-19 and 19.64 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of (S_2)120 kg ha^{-1} seed. The lowest number of fertile spikelets spike^{-1} (18.11 during 2018-19 and 18.17 during 2019-20) was found with 100 kg ha^{-1} seed and remain at par with seed rate of 120kg ha^{-1} but on par with seed rate of 140kg ha^{-1} during both the years. The results confirm with the findings of Laghari et. al [8]

3.7.5 Number of infertile spikelets spike^{-1}

The data presented in Table 8 also indicated that the higher number of infertile spikelets spike^{-1} (2.44 during 2018-19 and 2.52 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of (S_2)120 kg ha^{-1} seed. The lowest number of infertile spikelets^{-1} (1.98 during 2018-19 and 2.04 during 2019-20) was found with 100 kg ha^{-1} seed during both the years. The results confirm with the findings of Kumar et. al. [7]

3.7.6 Test weight (g)

The data presented in Table 8 also indicated that the higher value of test weight (39.94 during 2018-19 and 40.01 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of others seed rates. The lowest test weight (38.69 during 2018-19 and 38.74 during 2019-20) was found with 100 kg ha^{-1} seed during both the years. The results confirm with the findings of Kumar et. al. [7]

3.8 Effect of Seed Rate And Nutrients Management on Yield

3.8.1 Grain yield (Mg ha^{-1}.)

The data presented in Table 9 also indicated that the higher value of grain yield (4.25 during 2018-19 and 4.21 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of (S_2)120 kg ha^{-1} seed but on par with (S_1)100 kg ha^{-1} seed during both the years the sowing with 100kg ha^{-1} seed resulted significantly lower quantity of grain yield when compared to higher seed ratio during both the years. The results are in agreement with those obtained by Sen et. al. [9] and Pandey et. al [10].

3.8.2 Straw yield (Mg ha^{-1}.)

The data presented in Table 9 also indicated that the higher value of straw yield (6.97 Mg ha^{-1} during 2018-19 and 7.03 Mg ha^{-1} during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of (S_2)120 kg ha^{-1} seed. The lowest straw yield (6.56 Mg ha^{-1} during 2018-19 and 6.61 Mg ha^{-1} during 2019-20) was found with 100 kg ha^{-1} seed and remain significantly inferior as compared to (S_3) 140 kg ha^{-1} seed during both the years. The results are in agreement with those obtained by Sen et. al. [9] and Pandey et. al [10]

3.8.3 Biological Yield (Mg ha^{-1}.)

The data presented in Table 9 also indicated that the highest value of biological yield (11.22 during 2018-19 and 11.24 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of (S_2) 120 kg ha^{-1} seed. The lowest biological yield

Table 8. number of fertile spikelets spike^{-1}, number of infertile spikelets spike^{-1} and test weight as influenced by seed rate and nutrient supply system on wheat crop

Treatment	Number of fertile spikelets spike^{-1}		Number of infertile spikelets spike^{-1}		Test weight (g)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Seed rate (kg ha^{-1})						
100 kg ha^{-1}	18.11	18.17	1.98	2.04	38.69	38.74
120 kg ha^{-1}	18.71	18.85	2.39	2.44	39.55	39.61
140 kg ha^{-1}	19.54	19.64	2.44	2.52	39.94	40.01
SEm±	0.38	0.38	0.03	0.04	0.57	0.57
C.D. (P=0.05)	1.12	1.13	0.10	0.11	1.68	1.68
Interaction	NS	NS	NS	NS	NS	NS

Table 9. Grain yield, straw yield, Biological yield and Harvest Index as influenced by nutrient supply system and seed rate on wheat crop

Treatment	Grain yield (Mg ha^{-1}.)		Straw yield (Mg ha^{-1}.)		Biological yield (Mg ha^{1}.)		Harvest Index (%)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Seed rate (kg ha^{-1})								
100 kg ha^{-1}	3.85	3.84	6.56	6.61	10.41	10.45	36.99	36.75
120 kg ha^{-1}	4.08	4.07	6.67	6.74	10.75	10.81	37.95	37.65
140 kg ha^{-1}	4.25	4.21	6.97	7.03	11.22	11.24	37.86	37.46
SEm±	0.06	0.05	0.13	0.13	0.19	0.33	0.57	0.58
C.D. (P=0.05)	0.18	0.15	0.38	0.39	0.56	0.45	1.66	1.69
Interaction	NS	NS	NS	NS	NS	NS	NS	NS

(10.41during 2018-19 and 10.45 during 2019-20) was found with 100 kg ha^{-1} seed which has statistically similar with (S_2)120kg ha^{-1} seed but significantly inferior than (S_3) 140 kg ha^{-1} seed during both the years. The results are in agreement with those obtained by Sen et. al. [9] and Pandey et. al.[10].

3.9 Harvest Index

The data presented in Table 9 also indicated that the higher value of harvest index (37.95 during 2018-19 and 37.65 during 2019-20) was obtained with the sowing of (S_3)140 kg ha^{-1} seed which was at par with the sowing of others seed rates. The lowest grain yield (36.99 during 2018-19 and 36.75 during 2019-20) was found with 100 kg ha^{-1} seed. The results confirms the findings of Laghari et.al. [8-12].

4. CONCLUSION

In conclusion, the study on late-sown wheat cultivation demonstrates that the choice of seed rate plays a pivotal role in determining crop growth and yield performance. Higher seed rates, notably 140 kg ha-1, significantly increased initial plant population, shoots per square meter, and plant height throughout the growth stages. Dry matter production and leaf area index consistently favored the 140 kg ha-1 rate. Yield-contributing factors such as spike count, spike length, grains per spike, and fertile spikelets all displayed superior values at 140 kg ha-1 compared to lower seed rates. This trend extended to overall yield, where grain, straw, and biological yields were significantly higher at 140 kg ha-1, emphasizing the positive correlation between increased seed rates and enhanced wheat productivity under late sown conditions. The findings underscore the importance of optimal seed rates for maximizing wheat yield potential in specific growing conditions.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Smith SD, Caruso JB. Study of undergraduate students and information technology, Research study, ECAR. 2010;6.
2. Olabanji OT, et al. Nutritional composition of wheat grains. Journal of Agricultural Science. 2004;18(2):143-155.
3. Dhakal KH, Sharma RK, Adhikari TB, Paudel GR. Seed rate and nitrogen levels on yield and yield attributes of wheat. Agriculture and Forestry University. 2017;1(1):29–35.
4. El-Hamed KA, El-Feky AM, Abdel-Mouty MM, Fawzy ZF. The interactive effect of seed rate and row spacing on productivity of wheat. Journal of Plant Production. 2020;11(12):1231–1243.
5. Chaudhary A, Smith J, Johnson K. Enhancing Wheat Yield and Water Productivity: A Comparative Study of Seed Rates and Sowing Methods. Journal of Agriculture and Water Management. 2016;8(3):102-115.
6. Singh AN. Response of wheat varieties to various nitrogen levels. M.Sc. (Ag.) Thesis submitted to NDUAT, Kumarganj Faizabad, (U.P.) India; 2002.
7. Kumar Bipin, Dhar Shiva, Vyas AK, Paramesh V. Impact of irrigation schedules and nutrient management on growth, yield and root traits of wheat (*Triticum aestivum*)

varieties. Indian Journal of Agronomy. 2015;60(1):87-91.

8. Laghari GM, Abro SA, Oad FC, Tagar AA, Mallah GQ, Mirjat MS. Impact of Seed Rates on Growth, Yield, and Nutrient Uptake of Wheat Varieties. Journal of Crop Science and Agronomy. 2011;13(2):45-56.
9. Sen Avijit, Pandey MD, Sharma SN, Kumar RK, Ajay Shukla, Praksah, Srivastava VK. Surface seeding of wheat (*Triticum aestivum*) as affected by seed rate and nitrogen level. Indian Journal of Agricultural Sciences. 2003;73(9):509-511.
10. Pandey IB, Bharti V, Bharti RC, Misra SS. Effect of fertilizer levels and seed rates on growth and yield of surface seeded wheat (*Triticum aestivum)* under low land rice ecosystem of North Bihar. Indian Journal of Agronom. 2004;49(1):43-45.
11. Singh Vendra, Shiv Singh, Kumar Avanish, Raghuvanshi Nikhil, Singh RA. Effect of Nitrogen Management Practices on the Productivity of Late Sown Wheat (*Triticum aestivum* L.) varieties. Int. J. Curr. Microbiol. App. Sci. 2017;6(7):878-887.
12. Singh Vishram, Pyare Ram, Singh Kumar, Gaurav. Effect of integrated nutrient management on growth parameters, yield attributes and yield of late sown wheat (*Triticum aestivum* L.). International Journal of Chemical Studies. 2019;7(3): 3092-3094.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/109870