Environment & Ecology 35 (2A) : 834—838, April—June 2017
Website: environmentandecology.com ISSN 0970-0420

Production and Economics of Late Sown Wheat As Influenced By Sowing Time and Seed Rate under Semi Arid Environment

Avik Banerjee, Satyajeet, R. K. Nanwal

Received 20 June 2016; Accepted 27 July 2016; Published online 10 August 2016

Abstract An experiment was conducted during 2013-14 to study the effect of sowing time and seed rate on productivity and economics of wheat (*Triticum aestivum* L.) under late sown conditions. The results indicated that among different sowing times, sowing at 2nd December in wheat recorded maximum grain yield (53.03 q/ha), which was statistically significant than all other treatments. Significantly highest grain yield (56.87 q/ha) was recorded with 137.5 kg/ha seed rate under sowing date of 2nd December. The data pertaining to economics various treatments revealed that gross return, net return and B:C ratio were higher under sowing at 2nd December. Among the different seed rate highest gross return, net return, as well as B:C ratio was found highest with 137.5 kg/ha seed rate.

Keywords Production and Economics, Late sown wheat, Sowing time, Seed rate.

A. Banerjee*, Satyajeet, R. K. Nanwal
Department of Agronomy,
CCS Haryana Agricultural University,
Hisar 125004, India
e-mail : avikagro91@gmail.com
*Correspondence

Introduction

Wheat (*Triticum aestivum* L.) is a major cereal crop, which plays an important role in food and nutritional security. In India, three species of wheat is cultivated, 87% of cultivated wheat belongs to *Triticum aestivum*, 12% of cultivated wheat belongs to *Triticum durum* and one percent of cultivated wheat belongs to *Triticum dicoccum*. The global area of the wheat is 275.4 mha and production is 674.9 mt in 2012. In India, total area under wheat is 29.5 mha, with production of 93.62 mt and the productivity 3.1 t/ha [1].

Wheat is staple food which is eaten in the forms of chapattis, upmas and puris. Various other items like biscuit, cakes, flakes, leavened breads are made from wheat. Traditional Indian dishes like Dalia, Halwa are also made from wheat. Wheat straw is a good source of feed for a large population of cattle in India.

Generally sowing of wheat get delayed in Haryana due to late harvesting of cotton, rice or un-

Table 1. Yield and yield attributing characters as influenced by time of sowing and seed rate in wheat.

Treatments	Grain/ earhead	1000 grain weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Attraction index (%)
Time of sowing					
2nd Dec	46.53	43.32	53.03	58.80	90.19
9th Dec	42.81	41.22	49.75	58.63	84.85
16th Dec	38.42	35.63	43.16	58.30	74.03
23rd Dec	34.33	33.13	38.33	62.40	61.43
2nd Jan	33.00	30.61	36.28	62.93	57.65
SEm±	1.14	0.71	0.27	0.41	1.65
CD at 5%	3.73	2.31	1.01	1.33	5.48
Seed rate					
100 kg/ha	38.87	36.80	41.29	56.68	72.85
112.5 kg/ha	38.87	35.96	43.26	59.15	73.14
125 kg/ha	30.00	37.18	45.95	63.86	73.10
137.5 kg/ha	39.87	36.86	46.92	63.97	73.35
SEm±	1.05	0.87	0.28	0.29	0.07
CD at 5%	NS	NS	1.03	1.05	0.26

Table 2. Interaction effect of sowing time and seed rate on grain yield in wheat.

Time of sowing	Seed rate 100 kg/ha	112.5 kg/ha	125 kg/ha	137.5 kg/ha
2nd Dec	49.4	52.13	53.7	56.87
9th Dec	47	49.37	50.73	51.8
16th Dec	40.63	42.43	44.03	45.53
23rd Dec	35.37	36.9	39.53	41.53
2nd Jan	34.03	35.47	36.87	38.77
SEm±		0.22		
(sowing time × seed rate)				
CD at 5%		0.64		

precedented incessant rain in December and thus the rice fields do not come to optimum moisture condition before mid-January. The delayed sowing further cause supra-optimal thermal stress at reproductive phase which results in forced maturity [2]. Time of sowing is major agronomic practice in wheat contributing towards its productivity. Under late sown condition wheat may be sown up to 15th December in Haryana. After that there is drastic reduction in yield despite of best management practices [3]. Seed rate is also a major agronomic practice in wheat cultivation. Under normal sown condition 100 kg per hectare seed is needed [3]. Recommended row spacing limits the yield under late sown condition. Under such condition there is need to explore possibilities of increasing plant population per unit area for obtaining higher yields. To obtain higher yield potential of wheat under late-sown condition, higher seed rate is another important factor, which compensates the low tillering in wheat because of low temperature prevailing in December and January. Late sowing also reduces economic viability of wheat production with decreased yield. Present study was therefore undertaken to assess the optimum sowing and find the possibility of seed rate to compensate late sowing economically.

Materials and Methods

The experiment was conducted during 2013-14 at farm of Krishi Vigyan Kendra Fatehabad, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana (India). Fatehabad has semi-arid climate with severe cold during winter and hot dry and desiccating winds during summer. Weekly maximum and minimum temperature ranges were 17.0–35.5°C and 1.0–18.7°C, respectively. Morning relative humidity for the crop period ranged between 67 and 99%, whereas, evening relative humidity ranged between 28 and 64%. During the crop period, total amount of rainfall was 25.4 mm. The weekly mean wind velocity range for the crop season was 1.4–7.5 km per hour with almost increasing magnitude with the advancement of the crop season. The weekly mean sunshine hour range for the crop season was 1.7–9.3 h per day, Evaporative demand was highest during the month of April with 5.4 mm per day; whereas the lowest open pan evaporation was recorded during the month of January with 1.2 mm per day.

The texture of the surface soil of the experimental field was sandy loam, containing 56.4% sand, 20.8% silt and 22.8% clay. The basic infiltration rate was 4.6 mm/h. It contained 20.1 and 7.3% moisture, on weight basis, at -0.03 and -1.5 MPa, respectively. Available soil moisture in 0–90 cm soil layer was 15 cm. It was neutral (pH 7.4) in nature. The organic carbon content was 0.38% in the upper layer and decreased sharply to lower layers. Soil was low in available N (180 kg/ha), medium in available P (7.25 kg/ha)

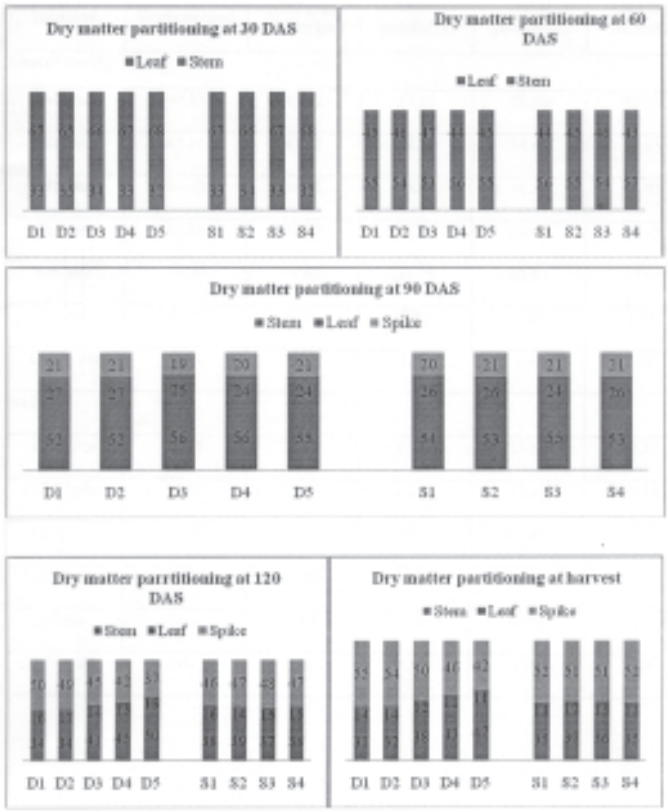

Fig. 1. Dry matter partioning at different stages of crop growth as influenced by time of sowing and seed rate in wheat.

and high in available K (183 kg/ha).

The experiment was laid out in strip plot design with 1st treatment having 5 levels and 2nd treatment having 4 levels and they were replicated thrice. The treatment 1 is date of sowing (D_1–2nd December; D_2–9th December; D_3–16th December; D_4–23rd December; D_5–2nd January). Treatment 2 is seed rate (S_1–100 kg/ha; S_2–112.5 kg/ha; S_3–125 kg/ha; S_4–137.5 kg/ha). Recommended levels of nitrogen, phosphorus and zinc sulfate (150:60:25 kg N, P_2O_5 and Zn SO_4 per ha) were applied as per standard package of procedure. Wheat variety WH 1021 was sown with seed rate as per treatment-1 and on sowing dates as per treatment-2. Four irrigations were applied to the crop. Recommended package of practices were followed for other production and protection operations. The economics of different treatments was calculated keeping in views the present market prices.

Results and Discussion

Growth studies

During 30 DAS, leaf and stem contribution towards total dry matter production in the ratio of 2:1 while at 60 DAS it was almost in the ratio of 40 and 60 towards total dry matter production irrespective of different sowing time and seed rate. During 90 and 120 DAS and at harvest the relative percent contribution of earhead dry weight towards total dry matter was more under 2nd December and 9th December sowing compared to other sowing dates. The relative per cent

Table 3. Economics of wheat as influenced by time of sowing and seed rate.

Treatments	Total cost (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C
Time of sowing				
2nd Dec	56808	83351	26543	1.47
9th Dec	56808	78889	22081	1.39
16th Dec	56808	69926	13118	1.23
23rd Dec	56808	64226	7418	1.13
2nd Jan	56808	61564	4756	1.08
Seed rate				
100 kg/ha	56433	67062	10629	1.19
112.5 kg/ha	56683	70231	13548	1.24
125 kg/ha	56933	74805	17872	1.31
137.5 kg/ha	57183	76136	18953	1.33

contribution of leaf: stem: earhead was 27:52:21 at 90 DAS, 16:34:50 at 120 DAS 14:31:55 at harvest under 2nd December sowing.The respective values under rest of sowing time were 27:52:21, 17:34:49 and 14:32:54, respectively (Fig. 1). Critical examination of data related to dry matter partitioning revealed that early sowing shows significantly higher earhead dry weight as compared to late sowing. Similar results were reported by Sanghera et al. [4]. Among seed rates, the relative percent contribution of leaf: stem in the total dry matter production was 67:33, 66:34, 67:33 and 68:32 at 30 DAS under seed rate of S_1, S_2, S_3 and S_4, respectively, while it was 44:56, 45:55, 46:54, 43:57 during 60 DAS. During 90, 120 DAS and at hervest, the contributuion of leaves and earheads towards total dry matter remains same with increasing seed rate.

Among yield attributing characters, significantly higher number of grains per earhead (46.53) was recorded in crop sown at 2nd December. However, number of grains per earhead was found statistically at par in crop sown at 9th December. However, number of grains per earhead was found statistically at par in crop sown at 9th December. Crop sown at 2nd January produced significantly less number of grains per earhead than other sowing times. Significantly higher value of 1000 grains weight (43.32) was recorded in crop sown at 2nd December. However, value of 1000 grains weight was found statistically at par in crop sown at 9th December. Crop sown at 2nd January produced significantly less value of 1000 grains weight than other sowing times. Similar results were also reported by Tomar et al. [5]. The number of grains per earhead and 1000 grain weight did not improved significantly with increasing seed rate from 100 kg/ha to 137.5 kg/ha. Similar results were reported by Nizmani et al. [6].

Yield studies

Grain yield of wheat, as influenced by different sowing time and seed rate data revealed that among different sowing times, sowing at 2nd December in wheat recorded maximum grain yield (53.03 q/ha), which was statistically significant than all other treatments. The increase in yield at 2nd December sowing was found to the tune of 6.6, 22.9, 38.4 and 46.2% higher over sowing at 9th December, 16th December, 23rd December and 2nd January. The pattern of increase in straw yield with successive leaves of sowing time was found similar to the pattern of increase in grain yield with successive levels of sowing time (Table 1). However, in the case of straw yield, 2nd December and 9th December sowing produced statistically non-significant results. Tomar et al. [5] showed that early sowing (14th November) gave 12.80% higher grain yield in comparison to that of 21 November date of sowing. The delayed sowing (8th December) reduced the grain yield (38.19 q/ha) which was 19.30% lower than that of 14 November date of sowing. Similar findings were reported by Mukherjee [7]. With each successive level of seed rate from 100 kg/ha to 137.5 kg/ha recorded higher grain yield. Among different seed rate, grain yield was found highest with application of 137.5 kg/ha seed which was at par with 125 kg/ha seed application. Application of 137.5 kg/ha seed was found to produce 13.6 and 8.5% higher grain yield over 100 kg/ha and 112.5 kg/ha seed rate respectively. The pattern of increase in straw yield with successive levels of seed rate was found similar to the pattern of increase in grain yield with successive levels of seed rate. Similar findings were also reported by Ram et al. [2]. The data showed that significantly higher value of attraction index (90.19) was recorded in crop sown at 2nd December. Crop sown at 2nd January produced significantly less value of attraction index than other sowing times. The value of harvest index did not improved significantly with increasing seed rate from

112.5 kg/ha to 137.5 kg/ha. Similar results were found by Alam et al. [8].

Interaction studies

The interaction effect of different sowing time and seed rate on grain yield of wheat was found significant. The data on grain yield revealed that all the five sowing times brought about significant increase in the grain yield. Under same level of seed rate, grain yield was found highest at 2nd December sowing (Table 2). Grain yield was found to increase significantly in sowing at 9th December compared to 16th December, 23rd December and 2nd January sowing. Significantly highest grain yield (56.87 q/ha) was recorded with 137.5 kg/ha seed rate under sowing date of 2nd December. Similar results were reported by Malik et al. [9].

Economics

The data pertaining to cost of cultivation, gross returns, net returns and B:C ratio for main effects of various treatments revealed that gross return, net return and B:C ratio were higher under sowing at 2nd December, followed by sowing at 9th December. Minimum net returns and B:C ratio were recorded under 2nd January sowing. A critical examine of data revealed that in general, cost of cultivation, gross return as well as net return increased with successive increase in seed rate from 100 kg/ha to 137.5 kg/ha. Among the different seed rate highest gross return, net return, as well as B:C ratio was found highest with 137.5 kg/ha seed rate (Table 3). It was further observed that the B:C ratio under 125 kg/ha seed rate was comparable with B:C ratio under 137.5 kg/ha seed rate. Similar finding have been reported by Tomar et al. [5].

References

1. Anonymous (2012) Statistical abstract. Govt of India.
2. Ram A, Pannu RK, Prasad D (2012) Effect of management practices on growth, yield and quality of late sown wheat (*Triticum aestivum*). Ind J Agron 57 : 92—95.
3. Prasad R (2012) Textbook of field crops production. Vol 1. Direct Knowledge Manag in Agric, ICAR, Krishi Anusandhan Bhawan, New Delhi, pp 65—98.
4. Sanghera AK, Thind SK (2014) Dry matter accumulation and partitioning in wheat genotypes as affected by sowing date mediated heat stress. Int J Sci Res 3 : 3—6.
5. Tomar SPS, Tomar SS, Srivastava SC (2014) Yield and yield component response of wheat (*Triticum aestivum* L.) genotypes to different sowing dates in Gird region of Madhya Pradesh. Int J Farm Sci 4 : 1—6.
6. Nizamani GS, Tunio S, Buriro UA, Keerio MI (2014) Influence of different seed rates on yield contributing traits in wheat varieties. J Pl Sci 2 : 232—236.
7. Mukherjee D (2012) Effect of sowing dates on growth and yield of wheat (*Triticum aestivum*) cultivars under mid hill situation of West Bengal. Ind J Agron 57 : 152—156.
8. Alam MP, Kumar S, Ali N, Manjhi RP, Kumari N, Lakra RK, Izhar T (2013) Performance of wheat varieties under different sowing dates in Jharkhand. J Wheat Res 5 : 61—64.
9. Malik AU, Ahmad M, Alias Bukhsh HA, Hussain I (2009) Effect of seed rates sown on different dates on wheat under agro-ecological conditions of Dera ghazi khan. The J Animal & Pl Sci 19 : 126—129.