Madras Agric. J. 91 (1-3) : 47-51 January-March 2004
https://doi.org/10.29321/MAJ.10.A00065

Response of rainfed wheat to sowing methods and seed rate under diara land condition

S.K. TOMAR
Dept. of Agron. Crop Res. Station, Narendra Deva Univ. of Agri. and Tech. Masodha, Faizabad (U.P.)

Abstract: A field study was conducted during 2000-01 and 2001-02 at Raunahi site of Saryu diara, Faizabad to study the effect of different sowing methods and seed rate on yield and economics of wheat crop under rainfed diara land condition. Cross sowing (20x20cm) gave significantly higher effective tillers (335.7 and 324.2/m^2) grain yield (4383 and 4170 kg ha^{-1}), straw yield 5555 and 5221 kg ha^{-1}) and monetary return (Rs.27806 and 28438 ha^{-1}) as compared to other sowing methods. Higher radiation use efficiency (1.95 and 1.82 g MJ^{-1}) was recorded with cross sowing narrow sowing, line sowing and broadcasting methods. Maximum radiation interception (93.0 and 91.6 per cent) was recorded with narrow sowing followed by cross sowing (89.7 and 87.3 per cent) over broadcasting (78.0 and 75.7 per cent) and line sowing (89.3 and 84.0 per cent). Line sowing proved its superiority over broadcasting in all respect. The seed rate of 125 kg ha^{-1} found to be most economical compared with 100 and 150 kg seed ha^{-1}.

Key words : Sowing methods, Seed rate, Grain yield, RUE, Economics.

ntroduction

Diara lands are such lands situated on he bank of river, flooded in Monsoon season nd new silt deposits every year. The word iara is taken from "Dia" means bowl shaped arthen lamp. In India 2.90 m ha area is under iara land out of which Uttar Pradesh contributes 7 per cent. Diara lands are available for cultivation fter September. Most of the farmers in eastern Jttar Pradesh prefer to grow wheat on these ands due to surety of crop that is availability f sufficient moisture and nutrients in the upper ayer of this soil and wheat has adventitious oot system which help to absorb more nutrients nd moisture from the soil. The reason for ow productivity is unavailability of suitable igh yielding variety for the diara lands, navailability of good quality seed and proper ecommendation of seed rate and fertilizer. Sowing ethods and proper seed rate are the basic nputs for the proper stand and use of available esource for production of wheat crop of rainfed iara land. Diara lands have sufficient moisture uring the growth and reproductive phase of he crop but during milky stage there is some scarcity of water, which affect the yield. Some times, winter rains improved the performance of crop and yield. For getting higher yield and net return maintenance of adequate plant density and fertile tillers are the most competent agronomic factors. Since information of these agronomic aspects of the wheat crop under rainfed diara lands is meager, an attempt was made to assess their effect on grain yield, economic and radiation use efficiency.

Methods and Materials

A field experiment was conducted during rabi winter season of 2000-01 and 2001-02 at Raunahi site of Saryu diara land, Faizabad under "AICRP for improvement of diara land", N.D.U.A.T. Kumarganj, Faizabad. The soil of the experimental area was sandy loam having pH 7.8, organic carbon 0. 19 per cent available, N, P and K (kg ha^{-1}) were 117, 5.6 and 185 respectively. The treatment comprised of four sowing methods (broadcasting, linc sowing (20 cm), narrow sowing (15 cm) and cross sowing (20x20cm) and three seed rates (100, 125 and 150 kg ha^{-1}).

The experiment was laid out in split plot design with three replications keeping sowing methods in main plot and seed rate in sub plot. The crop was sown on 29 and 30 November during 2000 and 2001, respectively. Total amount of fertilizer 120:60.40 kg NPK ha^{-1} was applied at the time of sowing. Radiation use efficiency was calculated by recording the biomass accumulation of above ground parts and photosynthetic active radiation at 15 days interval. Mean radiation use efficiency of the crop growth period is present here. Interception of photosynthetically active radiation was measured by 1M long line quantum sensor (Li Cor Linecolin USA) between noon and 2 PM. Periodical observation at 15 days interval was recorded for incident photosynthetically active radiation (PARo), transmitted PAR (TPAR), reflected PAR from Canopy (RPARc) and soil (RPARs). Absorbed photosynthetically active radiation (APAR) was determined by using the formula as given by Asrar *et al.* (1989).

$$APAR = (PARo + RPARs) - (TPAR + RPARc)$$

Periodical radiation use efficiency was determined by using the equation

$$RUE = \frac{\text{Amount of biomass production } (gm^{-2})}{\text{Amount of cumulative absorbed photosynthetical active radiation } (MJm^{-2})}$$

Results and Discussion

Sowing method

In both 2000-2001 and 2001-2002 years cross sowing was at par with narrow sowing and both recorded significantly higher plant height, leaf area index, grain ear^{-1} and test weight over line sowing and broadcasting (Table 1). Higher number of effective shoots m^{-2} (335.7 and 324.2) was also recorded with cross sowing followed by narrow sowing (310.7 and 303.8). These findings are in close conformity with the results of Dhilan and Kier (1981) and Prasad *et al.* (1991). Lowest number of effective shoots m^{-2}, leaf area index, grain ear^{-1} and test weight were recorded with broadcasting methods. Grain and straw yield were affected significantly by different sowing methods during both the years. Cross sowing (20x20 cm) recorded markedly higher grain yield (4353 and 4170 kg ha^{-1}) and straw yield (5555 and 5224 kg ha^{-1}) over other sowing methods. Narrow sowing gave significantly higher yield (4040 and 3895 kg ha^{-1}) over broadcasting during both the years and over line sowing (3886 and 3306 kg ha^{-1}) during 2001-02. Line sowing proved its superiority over broadcasting. These findings are in conformity with Patel *et al* (1986) and Prasad *et al.* (1991). Higher yield in cross sowing owing to more effective shoots m^{-2}, leaf area index, better harvest index, more radiation interception and radiation use efficiency (Fig.1). Higher radiation use efficiency (1.95 and 1.82g MJ^{-1}) in cross sowing might be due to optimum LAI and more availability of radiation through the canopy which increased the photosynthesis in lower leaves of the plants. Blum (1990) reported that higher RUE in wheat was associated with the higher carbon exchange rate, photosynthetic capacity and water use efficiency. Low radiation use efficiency in narrow sowing might be due to lower leaves receiving insufficient radiation for photosynthesis to balance respiration and more inter plant competition for space, water and nutrients.

Seed rate

In both 2000-01 and 2001-02, year increasing seed rate from 100 to 125 kg/h significantly increased the plant height, LA and effective shoots m^{-2}. Increase in seed rat from 125 to 150 kg ha^{-1} did not show an effect on yield and yield attributing character Similar response of wheat to seed rate wit 125 and 150 kg ha^{-1} has been observed b Sharma and Dhillon (1993), Upadhyay and Tiwari (1996) and Rawat *et al.* (2000). Grain and Straw yield increased significantly up to 125 kg ha^{-1} only.

Sowing with 125kg seed ha^{-1} recorded higher grain yield (4107 and 3638 kg ha^{-1}) over 100 kg seed rate ha^{-1}, which was 13.9

Fig.1. Radiation use efficiency (g/MJ) as affected by method of sowing
M1 = Broad casting, M2 = Line sowing, M3 = Narrow sowing, M4 = Cross sowing

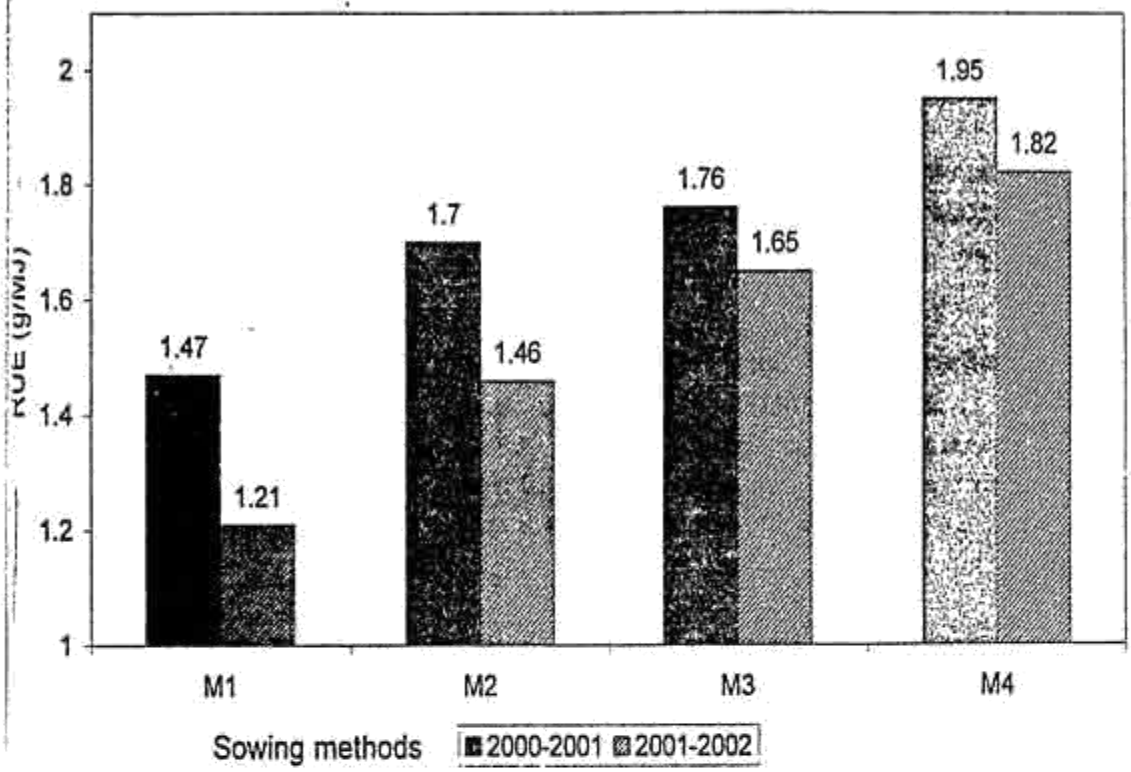
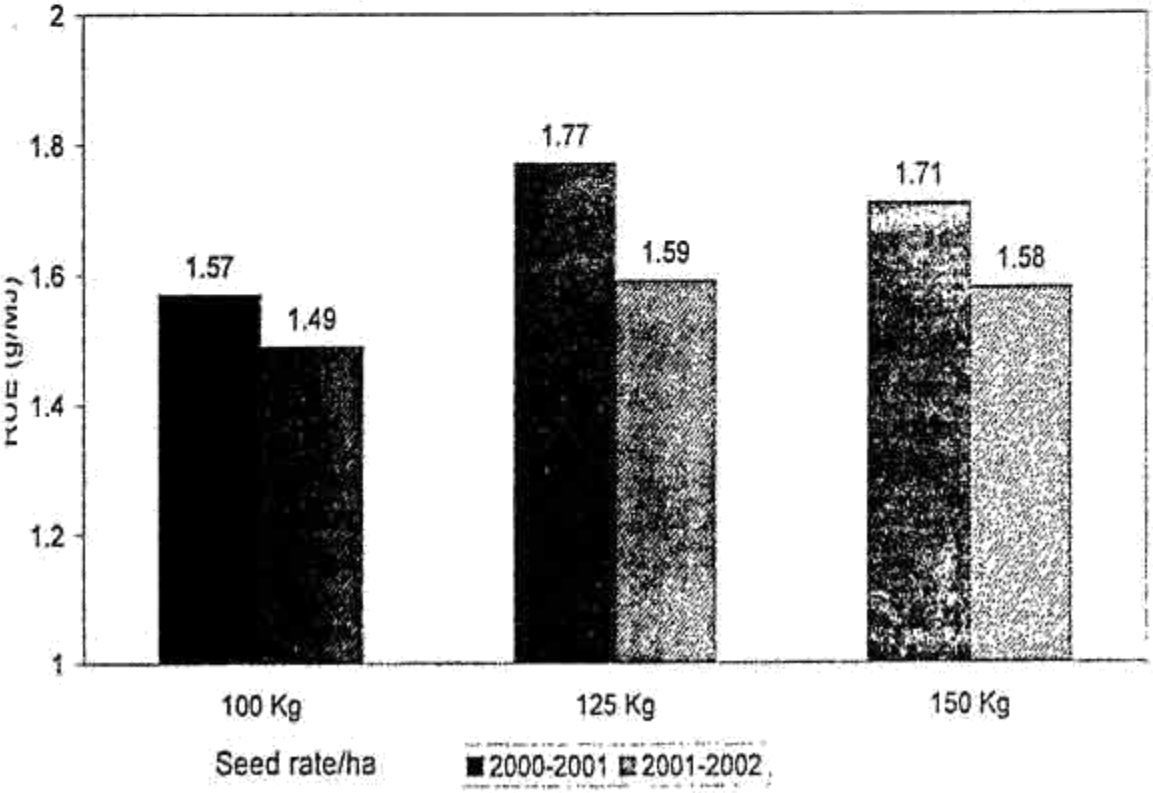


Fig.2. Radiation use efficiency (g/MJ) as affected by seed rate



and 11.0 per cent higher in grain yield and 15.9 and 15.4 percent higher in straw yield during I[st] and II[nd] year of experimen-tation, respectively. Higher grain yield with 125 kg seed rate ha^{-1} enabled the plant to produce optimum number of tillers, LAI and better interception of light which has undergone normal physiological growth and field duration resulting in more fertile shoots m^{-2}.

Highest radiation use efficiency (1.77 and 1.59 g MJ^{-1} in 2000-01 and 2001-02, respectively) was recorded with 125 kg seed ha^{-1} (Fig.2) owing to optimum LAI and less intra plant row competition for water, space, light and nutrient.

Economics

Highest net return of Rs. 27806 and 28438 ha^{-1} in 2000-01 and 2001-02, respectively was registered with cross sowing which was 9.6, 15.1 and 30.7 per cent higher over narrow sowing, line sowing and broadcasting, respectively during 2000-01 while during 2001-02, it was 6.9, 38.4 and 69.2 per cent higher. Narrow sowing produced significantly higher net return over line sowing and broadcasting. Lowest net return was recorded with broadcasting (Rs.21268 and 16811 ha^{-1}).

On an average significantly higher net return of Rs. 25066 and Rs. 25171 ha^{-1} were observed with 125 and 150 kg ha^{-1}, respectively which were (Rs.3271 and Rs.3376 ha^{-1}) higher than 100 kg seed ha^{-1}.

Table 1. Effect of sowing method and seed rate on growth and yield attributing characters of wheat

Treatment	Plant height (cm)		Leaf area index 75 DAS		Effective shoots (No./m^2)		Grain/ear (No.)		Test weight (g)		Radiation intercep-tion (%) 75 DAS	
	A	B	A	B	A	B	A	B	A	B	A	B
Sowing methods												
Broadcasting	92.7	91.7	2.89	2.27	255.3	239.7	35.6	33.3	35.33	33.56	78.0	75.7
Line sowing (20cm)	98.8	95.6	3.96	3.42	286.7	267.3	38.2	37.0	36.13	36.67	89.3	84.0
Narrow sowing (15 cm)	100.7	98.6	4.50	3.75	310.7	303.8	39.3	38.2	36.90	37.77	93.0	91.6
Cross sowing (20x20 cm)	100.3	101.3	4.79	3.90	335.7	324.2	39.3	39.0	36.73	38.22	89.7	87.3
CD at 5%	3.6	3.4	0.42	0.34	20.3	22.5	2.4	2.6	0.42	0.93	3.4	3.1
Seed rate (kg ha^{-1})												
100	96.5	93.8	3.55	3.12	272.3	261.5	40.0	37.0	37.5	37.92	83.0	80.0
125	100.4	98.5	4.14	3.39	310.8	292.2	38.1	37.1	35.92	36.5	87.5	86.3
150	100.7	100.8	4.32	3.50	315.3	307.5	38.0	35.5	35.05	35.25	89.0	87.3
CD at 5%	2.1	3.1	0.34	0.22	17.8	18.2	NS	NS	NS	NS	2.6	2.8

A = Year 2000-01
B = Year 2001-02

References

Asrar, G., Mynemi, R. B. and Kanemasu. (1989). Estimation of plant canopy attributes from spectral reflectance measurements. *In*: Theory and Application of optical remote sowing. John Wiley and sons Inc.. New York.

Treatment	Grain yield (kg ha^{-1})		Straw yield (kg ha^{-1})		Harvest index		Net return (Rs. ha^{-1})		Mean net return
	A	B	A	B	A	B	A	B	re
Sowing methods									
Broadcasting	3527	2447	4811	3699	0.423	0.435	21268	16811	19039
Line sowing (20cm)	3886	3306	5200	4095	0.428	0.446	24164	20548	22356
Narrow sowing (15 cm)	4040	3895	5344	5162	0.430	0.430	25361	26600	25981
Cross sowing (20x20 cm)	4383	417	5555	5221	0.441	0.444	27806	28438	28122
CD at 5%	269	222	308	304	NS	NS	1042	1232	1141
Seed rate (kg ha^{-1})									
100	3605	3275	4600	4128	0.439	0.442	22233	21357	21795
125	4107	3638	5475	4765	0.429	0.433	26018	24114	25066
150	4189	375	5608	504	0.427	0.427	25841	24500	25171
CD at 5%	191	145	312	361	NS	NS	1036	1152	1096

Price per quintal of grain and straw were Rs.590/- and 200 for 2000-01 and Rs.620 and 200 for 2001-02, respectively.
A = Year 2000-01
B = Year 2001-02

Blum, A. (1990). Variation among wheat cultivars in the response of leaf gas exchange to light. *Journal of Agriculture Sciences Compbell*, **115**: 305-11.

Dhillon, G.S. and Kier, D.S. (1981). Relation of shape of canopy to interception of radiation and yield of wheat. *J. Agri. Sci. U.K.* **97**: 135-142.

Patel, J.C., Vyas, M.M., Malviya, D.D. and Khanpara, V.D. (1986). Response of wheat to different planting patterns and Seed rates. *Indian J. Agron.* **31**: 256-258.

Prasad, K., Singh, P. and Prakash. (1991). Response of irrigated wheat to planting method, seed and fertilizer levels. *Indian J. Agron.* **36**: 44-48.

Rawat, A. K., Sharma, R.S., Dubey, A.K. and Naik, K. R. (2000). Refinement of agro-techniques for improving the productivity of wheat (*Triticum aestivum*) under rice (*Oryza sativa*)-wheat agro-ecosystem. *Indian J. Agron.* **45**: 636-640.

Sharma, J.S. and Dhillon, S.S. (1993). Effect of irrigation and fertilizer on growth, yield and nutrient uptake of wheat. *Indian J. Agron.* **41**: 48-51.

Upadhyay, V. B. and Tiwari, J. P. (1996). Influence of nitrogen, seed rate andmulch on wheat varieties under late sown' conditions. *Indian J. Agron.* **41**: 562-565.

(Received: January 2003; Revised: September 2003)