http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 4 (9): 1087-1089, 2001

Effect of Tillage Practices and Seed Rates on Wheat

Mohammad Arif, Khair Mohammad Kakar, Riaz Ahmad and [1]Shaukat Ali
Department of Agronomy, NWFP Agricultural University Peshawar, Pakistan
[1]Department of Agricultural Extension, Quetta, Balochistan, Pakistan

Abstract: The effect of tillage operations, one plough (minimum tillage), two plough (conventional tillage) and four plough (maximum tillage) and seed rates, 75, 100, 125, 150 and 175 kg ha^{-1} on wheat were studied. Statistical analysis of the data revealed that different tillage operations had significantly affected tillers/m^2, thousand grain weight, number of grains/spike and grain yield. Maximum tillers/m^2 (305), thousand grain weight (43.2 g), number of grains/spike (57) and grain yield (6266 kg ha^{-1}) were obtained from plots ploughed four times. Maximum tillers/m^2 (324), grains per spike (59), thousand grain weight (42.9) and grain yield (6266 kg ha^{-1}) were recorded at seed rate of 100 kg ha^{-1}. Interaction between tillage practices and seed rate had a significant effect on tillers/m^2, thousand grain weight, number of grains/spike and grain yield of wheat. As interaction between tillage operations and seed rates was significant therefore separate regressions were fitted to the data and x_{max} was calculated from the equation $Y = a + bx + cx^2$ for each parameter and treatment as -b/2c.

Key words: Tillage, seed rates, wheat

Introduction

Wheat is a staple and indispensable food article of the people and occupies more land than any other crop. Tillage is intended to destroy weeds, incorporate crop residues, increase infiltration and reduce evaporation. It prepares seedbed and break hard layers to facilitate the root penetration. Ahmad *et al*. (1990) concluded that proper tillage practices are necessary for better grain yield. Tillage practices maintain the productivity of agricultural lands by recycling and regenerating the essential plant nutrients from crop residues, humus and other forms unavailable to plants. Appropriate tillage practices improve soil structure, moisture, air and temperature, which ultimately increase the number and activities of microorganisms. Brouer (1990) assesed that less tilled soil had lower yield and higher proportions of weeds, while yield was lofty in maximum tilled soil. Masand *et al*. (1994) and Singh *et al*. (1994) reported that grain yield was higher with conventional tillage than minimum tillage, while yield with deep tillage was not significantly different from conventional tillage in wheat. It is unfortunate that many farmers in Pakistan do not understand the concept of moisture conservation and tillage. They even do not have the equipment required to do the job properly.

Diverse sort of opinions are found about the seed rate of wheat; Bhatnagar *et al*. (1990) studied seed rates of 100,125,150,175 or 200 kg ha^{-1} and found that yield was maximum at highest seeding rate of 200 kg ha^{-1}. Nayital and Sharma (1990) and Singh and Uttam (1993) recommended seed rate of 100 kg ha^{-1} for high grain yield. The present experiment was conducted to study the effect of tillage and to determine the optimum seed rate for getting maximum yield of wheat.

Materials and Methods

Experiment was carried out at Agricultural Research Farm, NWFP Agricultural University, Peshawar, during 1999. The experiment was laid out in randomized complete block design with three replications and net sub-plot size of 5 x 4m^2. Tillage operations, one plough operation (minimum tillage), two plough operations (conventional tillage) and four plough operations (maximum tillage) and seed rates 75, 100, 125, 150 and 175 kg ha^{-1} were compared in the study.

Fertilizers were applied at the rate of 120 kg N ha^{-1} and 90 kg P_2O_5 ha^{-1} at the time of sowing. Wheat variety Bakhtawar-92 was planted in rows 30 cm apart. Data were recorded on tillers/m^2, thousand grain weight, number of grains/spike and grain yield of wheat. Data were analyzed statistically using SAS (SAS institute 1986) and regressions analysis were carried out using the Excel-97 computer program.

Results and Discussion

Tillers per m^2: Tillers/m^2 of wheat as affected by tillage operations and seed rates are shown in Table 1 and Fig. 1. The original data points revealed that four plough operations and seed rate of 100 kg ha^{-1} produced maximum tillers/m^2 as compared to other treatments. It can be inferred from the data that tillers/m^2 increased with number of ploughings and seed rate was increased from 75 kg ha^{-1} to 100 kg ha^{-1} but further increase in seed rate decreased tillers/m^2. This might be due to the fact that use of high seed rate may cause lodging, exhaustion of nutrients and water and may provide favorable conditions for insects and diseases. This results are agreed with the findings of Mahajan *et al*. (1991), who reported that tillers/plant decreased with increase in seed rate. The X_{max} calculated for one plough operation displayed that tillers/m^2 were lofty at seed rate of 135 kg ha^{-1}. The X_{max} for two plough operations manifested that tiller/m^2 were highest at seed rate of 130 kg ha^{-1} and tillers/m^2 were eminent at seed rate of 129 kg ha^{-1} for four plough operations.

Thousand grain weight (g): Thousand grain weight of wheat as affected by seed rates and tillage operations are presented in Table 2 and Fig. 2. The original points of the data indicated that thousand grain weight was maximum for four plough operations and at seed rate of 100 kg ha^{-1}. The results are confirmed by Chaudhry and Sharif (1985), who stated that increased number of ploughing increased the thousand grain weight.

As interaction between seed rates and tillage operations was significant therefore, separate regressions were fitted to the data and X_{max} was calculated from the equation for two and four plough treatments and a linear trend line for one plough treatment. The linear trend line for one plough operation showed that thousand grain weight decreased with increase in seed rate from 75 to 175 kg ha^{-1}. The X_{max} for two plough operations indicating that thousand grain weight was maximum at seed rate of 106 kg ha^{-1} and X_{max} for four plough operations intimated that heavy grains were noted at seed rate of 81 kg ha^{-1}.

Table 1: Tiller/m² of wheat as affected by tillage operations and seed rate.

Seed rate (kg ha⁻¹)	Tillage (number of ploughings)			Mean
	One plough	Two plough	Four plough	
75	257 h	258 h	260 h	258 d
100	303 de	325 b	345 a	324 a
125	283 g	309 cd	318 bc	303 b
150	287 fg	299 de	297 def	295 c
175	285 g	291 efg	302 de	293 c
Mean	283 b	297 a	305 a	

LSD value for tillage at P≤0.05 = 12.85
LSD value for seed rate at P≤0.05 = 6.85
LSD value for interaction at P≤0.05 = 11.86
Means of the same category followed by different letters are significantly different at P≤0.05

Table 2: Thousand grain weight (g) of wheat as affected by tillage operations and seed rate.

Seed rate (kg ha⁻¹)	Tillage (number of ploughings)			Mean
	One plough	Two plough	Four plough	
75	42.3 be	41.0 eh	43.7 b	42.3 ab
100	40.7 fgh	42.7 bcd	45.3 a	42.9 a
125	40.8 fgh	41.5 dg	43.2 bc	41.8 b
150	40.0 h	40.7 fgh	42.0 cf	40.9 c
175	38.5 i	40.5 gh	41.8 cg	40.3 c
Mean	40.5 b	41.3 b	43.2 a	

LSD value for tillage at P≤0.05 = 1.2
LSD value for seed rate at P≤0.05 = 0.8
LSD value for interaction at P≤0.05 = 1.4
Means of the same category followed by different letters are significantly different at P≤0.05

Table 3: Number of grains/spike of wheat as affected by tillage operations and seed rate.

Seed rate (kg ha⁻¹)	Tillage (number of ploughings)			Mean
	One plough	Two plough	Four plough	
75	52 cde	53 cd	58 b	54 b
100	54 bcd	55 bcd	70 a	59 a
125	48 ef	51 de	56 bc	52 c
150	45 fg	48 ef	51 de	48 d
175	42 g	45 fg	48 ef	45 e
Mean	48 b	50 b	57 a	

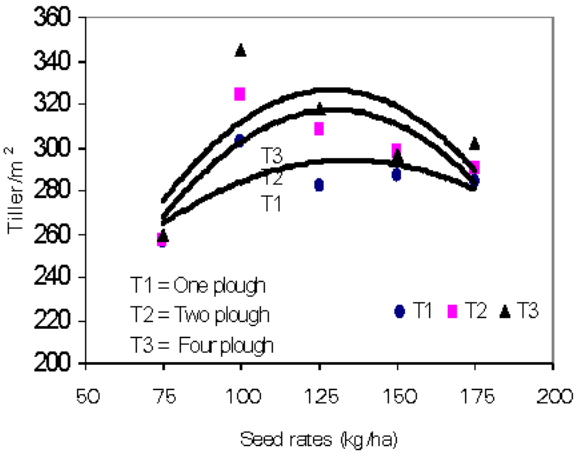
LSD value for tillage at P≤0.05 = 5.1
LSD value for seed rate at P≤0.05 = 2.7
LSD value for interaction at P≤0.05 = 4.6
Means of the same category followed by different letters are significantly different at P≤0.05 using LSD test.

Table 4: Grain yield (kg ha⁻¹) of wheat as affected by tillage operations and seed rate.

Seed rate (kg ha⁻¹)	Tillage (number of ploughings)			Mean
	One plough	Two plough	Four plough	
75	5172	5420	6075	5556 b
100	5768	6047	6864	6226 a
125	5077	5590	6270	5646 b
150	4877	5429	6340	5549 b
175	4746	5135	5779	5220 c
Mean	5128 b	5524 b	6266	

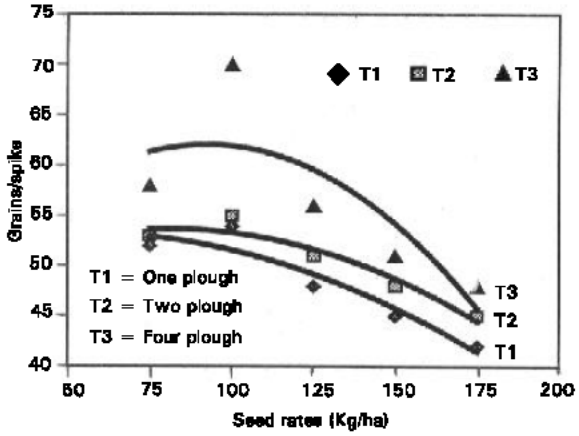
LSD value for tillage at P≤0.05 = 652
LSD value for seed rate at P≤0.05 = 215

Grains/spike: Grains/spike of wheat as affected by tillage operations and seed rates are shown in Table 3 and Fig. 3. The original data points revealed that four plough operations and seed rate of 100 kg ha^{-1} produced maximum grains/spike as compared to other treatments. It can be assumed from the data that grains/spike increased with number of ploughings from one to four plough operations and when seed rate was increased from 75 to 100 kg ha^{-1} but further increase in seed rate decreased the grains/spike. Similar results were also reported by Singh and Uttam (1993b) who examined that the highest number of grains/spike was produced at the seed



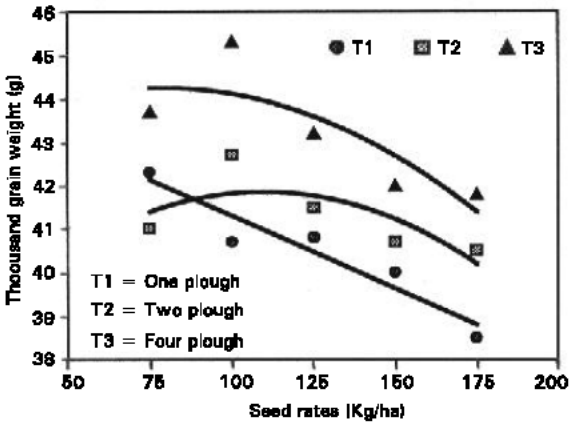
y T1) = $-0.0082x^2+2.2171x+144.71$
R^2 = 0.4838
X_{max} = 135
y (T2) = $-0.0165x^2+4.2743x+39.829$
R^2 = 0.6598
X_{max} = 130
y(T3) = $-0.0176x^2+4.544x+33.4$
R^2 = 0.4718
X_{max} = 129

Fig. 1: Tillers/m2 of wheat as affected by seed rates and tillage operations.



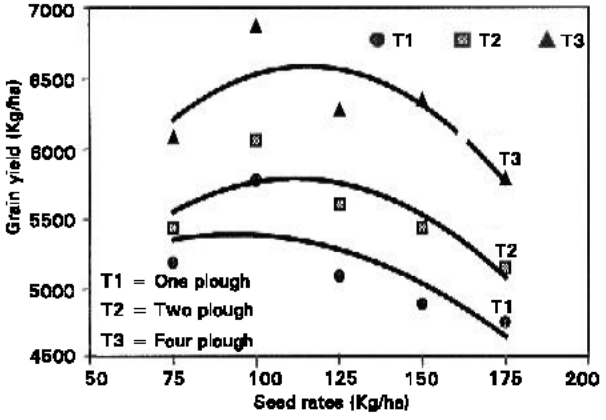
y (T1) = $-0.0008x^2+0.084x+51.2$
R^2 = 0.905
X_{max} = 52
y (T2) = $-0.001x^2+0.1651x+47.114$
R^2 = 0.9286
X_{max} = 83
y(T3) = $-0.0024x^2+0.444x+41.6$
R^2 = 0.6396
X_{max} = 93

Fig. 2: Grains per spike of wheat as affected by seed rates and tillage operations



y T1) = −0.0332+44.61
R^2 = 0.905
y (T2) = $-0.0004x^2+0.0851x+37.194$
R^2 = 0.5588
X_{max} = 106 kg/ha
y(T3) = $-0.0003x^2+0.0487x+42.314$
R^2 = 0.69
X_{max} = 81 kg/ha

Fig. 3: Thousand grain weight of wheat as affected by seed rates and tillage operations.



y T1) = $-0.1101x^2+20.542x+4417.4$
R^2 = 0.5939
X_{max} = 93 kg/ha
y (T2) = $-0.1767x^2+39.419x+3578.3$
R^2 = 0.6945
X_{max} = 111 kg/ha
y(T3) = $-0.2327x^2+53.707x+3478.7$
R^2 = 0.6606
X_{max} = 115 kg/ha

Fig. 4: Grain yield of wheat as affected by seed rates and tillage operations.

rate of 100 kg ha^{-1}, but at the highest sowing rate, grains number decreased significantly. The X_{max} calculated for one plough operation exhibited, that grains/spike were maximum at seed rate of 52 kg ha^{-1}. The X_{max} for two plough operations demonstrated that grains/spike were lofty at seed rate of 83 kg ha^{-1} and grains/spike were eminent at seed rate of 93 kg ha^{-1} for four plough operations.

Grain yield (kg ha^{-1}): Grain yield of wheat as affected by seed rates and tillage operations is presented in Table 4 and Fig. 4. The original points of the data showed that seed rate of 100 kg ha^{-1} produced maximum grain yield as compared to other treatments in each tillage treatment. It can be concluded from the mean data that grain yield increased from one to four plough operations and when seed rate was increased from 75 to 100 kg ha^{-1} but further increase in seed rate decreased the grain yield. The results are endorsed by Shrivastava *et al.* (1994) and Singh and Uttam (1993b) who recommended seed rate of 100 kg ha^{-1} for higher grain yield. As interaction between seed rates and tillage operations was significant, separate regressions were fitted to the data and X_{max} was calculated as -b/2c. The X_{max} calculated from the equation for one plough operation revealed that grain yield was maximum at seed rate of 93 kg ha^{-1}. The X_{max} calculated from the equation for two plough operations indicated that grain yield was maximum at seed rate of 111 kg ha^{-1} and the X_{max} for four plough operations showed that grain yield was maximum at seed rate of 115 kg ha^{-1}. It can be concluded that four plough operations and seed rate of 100 kg ha^{-1} produced maximum grain yield and hence it is suggested that farmers should plough their soil four times and use seed rate of 100 kg ha^{-1}.

References

Ahmad, M.K., M.S. Khan and M.I. Makhdum, 1990. Influence of different tillage implement for wheat production in Barani areas of the Punjab. Sarhad J. Agric., 6: 179-184.

Brouer, B., 1990. Tillage systems for winter wheat on young marsh soil. Landtechnik. Institut fur Landwirtschaftliche Verfahrenstechnik, Max-Eyth-Str. 6, 2300 Kiel, German Federal Republic., 45: 260-262.

Chaudry, M.S. and S.M. Sharif, 1985. Dry land wheat production in the western part of Libya. I. Response to deep tillage and N.P. fertilizers. Libyan J. Agric. 1982, 11: 15-22.

Mahajan, A.K., D.P. Dubey, K.N. Namdeo and N.P. Shukla, 1991. Response of late sown wheat to seed rates and seed soaking sprouting. Ind. J. Agron., 36: 288-290.

Masand, S.S., O.C. Kapur and C.M. Sharma, 1994. Effect of tillage and nitrogen on yield and water use efficiency of rainfed wheat in Palam Valley of Himachal Pradesh. J. Ind. Soc. Soil Sci., 42: 645-647.

Masand, S.S., C.M. Sharma and R.S. Minhas, 1992. Effect of tillage methods and nitrogen levels on the yield and N uptake by wheat in a hilly terrain. J. Ind. Soc. Soil Sci., 40:549-552.

SAS Institute Inc., 1986. SAS User Guide; SAS Circle P.O Box 8000 Cary, N.C. 27511-8000.

Shrivastava, U.K., R.L. Rajput and N.K. Sinha, 1994. Effect of seed rate, fertility levels and weeding on the yield of wheat. Agricultural Science Digest Karnal. Khargone 451001, Madhya Pradesh, India, 14:5-7.

Singh, V.P.N. and S.K. Uttam, 1993a. Response of wheat cultivars to tillage management practices and fertility levels under rainfed conditions in the Bundelkhand region. Bhartiya Krishi Anusandhan Patrika, 8:171-178.

Singh, V.P.N. and S.K. Uttam, 1993b. Effect of seed rate and inter-row spacing on yield attributes and yield of wheat variety HD 1981 (Pratap) under rainfed condition of central Uttar Pradesh. Agricultural Science Digest Karnal. Kanpur 208002, Uttar Pradesh, India, 13:117-121.

Singh, P.K., Y. Singh and J. Kwatra, 1994. Effect of tillage and planting management on yield and economics of rice-wheat cropping system. Agric. Sci. Digest Karnal, 14:41-43.