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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 (6): 657-659, 2001

Influence of Sowing Methods and Mulching on Yield and Yield Components of Wheat

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Abstract: Proper sowing method is important for crop establishment and mulching has a beneficial effect on soil physical properties. Keeping this in view, a study was carried out to evaluate the sowing methods and mulching effect on yield and yield components of wheat (*Triticum aestivum* L.). Two sowing methods and two mulching materials with no mulching treatments were used. Line sowing produced significantly higher yield components and grain yield. The harvest index and straw yield was also higher for line sowing than broadcast sowing. Mulching practice increased the spike population, while grains per spike and grain weight remained unaffected. Higher grain and straw yields were obtained with mulching. Line sowing and mulching with 4 t ha^{-1} of sorghum stover are recommended for optimum grain and straw yields of wheat.

Key words: Sowing methods, mulching, yield components, wheat

Introduction

Cereal straw and other crop residue mulches placed over soil surface have proved to be very effective in modifying the soil physical properties (Layton *et al.*, 1993), increase soil permeability, aeration and root penetration (Hage, 1993) as a result, the crop established well. Similarly, a straw mulch will also allow rain water to pass through, while at the same time reducing water droplet impact. The most beneficial effect of mulching is the reduction of water run-off, evaporation (Singh and Singh, 1994) and soil erosion (Khatibu *et al.*, 1984). Similarly it conserves soil moisture (Mullins *et al.*, 1992; Acharya and Kapur, 1993), control weeds (Davis, 1994) and regulate the soil temperature (Tindall *et al.*, 1991). Mulches have been used profitably to increase yield in grain and root crops (Okigbo and Lal, 1980) and are known to suppress weed growth in maize (Agboola and Udom, 1967). Asoegwn (1987) reported that mulch increased plant establishment and yield in leafy amaranths. Mulched tomato plants grew taller and had greater fruit weight than stalked plants or unmulched (Olasantan, 1985). Dayal *et al.* (1991) reported that wheat straw mulch increased number and weight of groundnut pods per plant resulting in higher pod yield. Wicks *et al.* (1994) recorded higher maize yield with wheat straw mulch between 3.4 - 5.1 t ha^{-1} because of greater number and weight of kernels. Acharya and Kapur (1993) stated that mulching 10 t ha^{-1} DM of maize had significantly increased wheat grain yield. Furthermore, wheat crop utilized approximately 40 kg N ha^{-1} from maize mulching.

A key factor in the high wheat production is the sound understanding of early crop establishment. Besides other agronomic practices, sowing method is the one, which determine the crop stand and ultimately economic yield. Many researchers favored line/row sowing (Mulay *et al.*, 1991; Hossain and Maniruzzaman, 1992; Sharma, 1992) but some recommended broadcast sowing because of speedy and timely sowing (Collins and Fowler, 1992) and higher net profit (Kumar and Tripathi, 1991). Higher grain yield from line sowing compared to broadcast sowing are reported by Singh and Singh (1992), Singh and Uttam (1992) and Singh *et al.* (1993). Chang *et al.* (1991) concluded that drill sowing resulted 7-17% higher forage yield than broadcasted rye and the winter soil temperature were 0.3 - 2.3 ^{0}C higher with the drilled sowing than broadcast sown plots.

Keeping in view the importance of mulching and sowing methods, this study was designed to understand the effect of these agronomic practices on the yield and yield components of wheat.

Materials and Methods

The experiment was conducted at Malakandher Research Farm, NWFP Agricultural University, Peshawar during 1998-99. The experiment was laid out in Randomized Complete Block Design having four replications with a net plot size of 5 x 2 m. Sorghum and maize stover were used as mulching materials.

Control plots were also included in the experiment where no mulching was done. Chopped sorghum and maize stover were evenly spread over immediately after sowing in the designated plots at a rate of 4 t ha^{-1}. Wheat variety Inquilab-91 was sown either in lines with a row spacing of 30 cm or broadcasted. A seed rate of 100 kg ha^{-1} was used for both sowing methods.

The number of productive spikes were counted in one meter long row (line sowing) at five points and in a square quadrate (broadcast sowing) at various points in each plot and spike population (m^{-2}) was calculated. The number of grains per spike was calculated by counting grains of ten randomly selected spikes from each treatment and average number of grains per spike was obtained. Grain weight was recorded by weighing 1000 grains from each treatment. Central rows of the line sowing treatments and whole plots of the broadcast sowing treatments were harvested. Bundles were made after harvest, air dried and their dry weight was recorded. Grain weight was noted after threshing and cleaning. Straw weight was recorded by subtracting grain weight from the bundle weight for each treatment. The grain and straw weight per plot were converted into kg ha^{-1}. Harvest index for each treatment was calculated as: grain yield/biological yield x 100. F-test was used to detect the significance of treatments' effect and the LSD was applied for mean comparison.

Results and Discussion

Line sowing proved to be superior than broadcast sowing for the essential yielding components of wheat. Line sowing had significantly more spike population, grains per spike and grain weight than broadcast sowing (Table 1). Wheat sown in line had 56, 19 and 5% more spikes, grains per spike and heavier grains than broadcast sowing, respectively. The production of

Table 1: Effect of sowing methods and mulching on spikes, grains per spike and grain weight of wheat

Treatment	Spike population (m^{-2})	Grain $spike^{-1}$	1000 grain weight (g)
L-No Mulch	362	42	44.64
L-Sorghum	509	45	46.84
L-Maize	408	44	45.11
B-No Mulch	222	35	42.56
B-Sorghum	262	39	45.05
B-Maize	336	37	43.11
LSD(0.05)	90	NS	NS
Line	426	44	45.53
Broadcast	273	37	43.57
LSD(0.05)	**	**	*
No Mulch	292	38	43.60
Sorghum	385	42	45.94
Maize	372	40	44.11
LSD(0.05)	63	NS	NS
Interaction	*	NS	NS

L = Line sowing B = Broadcast sowing NS = non-significant
*,** = significant at 0.05 and 0.01 level of probability, respectively

Table 2: Effect of sowing methods and mulching on grain yield, straw yield and harvest index of wheat.

Treatment	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
L-No Mulch	2059	6305	32.66
L-Sorghum	2360	6802	34.70
L-Maize	2271	6448	35.21
B-No Mulch	1946	6139	31.71
B-Sorghum	2106	6380	33.00
B-Maize	2024	6256	32.36
LSD(0.05)	43	83	0.70
Line	2230	6518	34.19
Broadcast	2025	6258	32.35
LSD(0.05)	**	**	**
No Mulch	2003	6222	32.18
Sorghum	2233	6591	33.85
Maize	2147	6352	33.78
LSD(0.05)	30	59	0.50
Interaction	**	**	**

L = Line sowing B = Broadcast sowing ** = significant at 0.01 level of probability.

greater yielding components of wheat can be attributed to improved light penetration (Chang *et al.*, 1991) and utilization because of the well spaced plant population. Similarly lined sown crops are considered superior in water use efficiency (Hossain and Maniruzzaman, 1992) while, broadcast sowing is generally inferior as noted by Collins and Fowler (1992).

Mulched plots produced 30% more spikes per unit area than unmulched plots. Among mulching material of sorghum or maize, there were no significant difference for spike population. However, those treatments where line sowing was done and mulched with sorghum stover had the highest (509) spikes m^{-2}. Number of grains per spike and grain weight showed no significant response to mulching. Most probably the modified and favorable environment for root development and penetration (Hage, 1993) gave the advantage to the mulched plots to produce more tillers resulting in more spikes than unmulched plots.

Sowing methods and mulching significantly affected grain yield, straw yield and harvest index (Table 2). Line sowing produced higher grain and straw yield, greater harvest index and greater yielding components (Table 1) than broadcast sowing. Line sown crop produced 2.23 and 6.52 t ha^{-1} of grain and straw as compared to 2.03 and 6.25 t ha^{-1} of grain and straw by broadcast sowing. Many researchers (Geleto *et al.*, 1995; Jan and Khan, 2000) obtained the same relationship.

Mulching had a significant effect on grain yield, straw yield and harvest index. Plots mulched with sorghum or maize stover produced significantly higher grain and straw yield than unmulched treatments. Similarly harvest index was greater for mulched treatments. The beneficial effect of mulched material on maximum tillers and spike production resulted in higher grain as well as straw yield. Since mulched materials have the ability to increase water holding capacity of the soil (Li *et al.*, 1991), retard soil evaporation (Schillinger and Bolton, 1993) and control weeds to the acceptable level (Davis, 1994) resulting in higher economic and biological yields. Uttam and Das (1992) obtained the same results of having increased wheat yield with mulching of 4 t ha^{-1} of maize stover. Sowing wheat in lines and mulching with 4 t ha^{-1} of sorghum stover are recommended for higher grain and straw yields.

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