

PROSPECTS OF WHEAT AS A DUAL PURPOSE CROP AND ITS IMPACT ON WEEDS

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ABSTRACT

Improvement in livestock production depends on the quality and quantity of feed available. The objective of this study was to look into the potential use of wheat as a dual-purpose crop and its impact on weeds. The experiment was conducted at Agricultural Research Farm, NWFP Agricultural University Peshawar during rabi 2005-06. Randomized complete block design with three replications was used. Wheat variety Fakhre-sarhad was sown with the help of a seed drill at seed rate 100 kg ha⁻¹. A plot size of 5 x 1.8 m with row to row distance 22 cm was used. A cut was given to half of the plots as per treatments arrangement about 60 days after sowing. At the time of cut, the crop was at jointing stage and was ready to be used as fodder. Perusal of the data indicated that non-cut plots produced significantly more spikes, grains spike⁻¹, grain weight, grain yield and biological yield. Similarly no cut wheat suppressed weeds while in cut plots weed density was greater due to open habitat for weeds to germinate and flourish. However economic analysis indicated that income of the cut plots was at par with the income of the non-cut plots. It is concluded that wheat can be used as a dual-purpose crop to provide sufficient feed to the starving livestock in Pakistan however weeds problem need to be addressed to avoid the weed seed deposition in the soil.

Key words: Wheat, weeds, fodder, dual purpose crop

INTRODUCTION

Wheat (*Triticum aestivum* L.) is used as a major source of food all over the world. It is also known as 'King of cereals'. It is the staple food of Pakistan and meets the major dietary requirements; supplies about 73% of the calories and protein of the average diet (Heyne, 1987). Beside food, wheat is also used for livestock and poultry feed. Like other grasses, it produces several tillers plant⁻¹, depending soil fertility, crowding and environmental conditions (Khan *et al.*, 2004). Wheat can provide high quality forage for livestock (Horn, 1984). The forage is usually high in moisture and soluble constituents during fall and winter and may be unable to meet the daily dry matter (DM) intake requirements of livestock. At that time, crude protein concentration of wheat is high, sometimes exceeding 30% of DM and fiber concentration is low.

Forage availability for livestock is reduced during the winter period, so grazed cereals-mainly oat (*Avena sativa* L.), rye (*Secale cereale* L.), or barley (*Hordeum vulgare* L.) are used to provide good quality forage during the 3 to 4 months of reduced forage production. Currently, owing to low profits from grain crops, many farmers are attempting to shift to forage crops (Persian clover, Egyptian clover) or other cash crops (sugarcane, tobacco, sugar beet etc).

Weeds are one of the biggest threats to agriculture. Weeds reduce the crop yield and deteriorate the quality of produce and hence reduce the market value of wheat. They use the soil fertility, available moisture, nutrients and compete for space and sunlight with crop plant, which result in yield reduction (Khan *et al.* 2004). Annual losses in wheat amount to more than Rs. 28 billion at the national level and Rs. 2 billion in NWFP (Hassan and Marwat, 2001). In early sown wheat, weeds are suppressed but after taking a cut from the wheat crop as forage in the late fall, new weeds germinate or the existing weeds find an opportunity to flourish in the absence of competition with the crop and thus negatively affect the yield and yield components of wheat.

The use of wheat as a forage and grain dual-purpose (DP) crop is aimed at reducing competition between area devoted to grain and forage crops. The income stability of this system should be higher because both livestock and wheat commodities are available for market (Diaz *et al.*, 1986; Redmon *et al.*, 1995). In several countries the DP system has been used extensively (Diaz-Rosello *et al.*, 1993). Farmers in the USA use DP winter wheat to increase income in relation to grain only crop production (Horn *et al.*, 1994). Redmon *et al.* (1995) demonstrated the contribution of each product (livestock and grain) to the stability of farm income. Information from grazing experiment shows that grain production decrease by increase in

grazing duration. In a 5 years study, Hernandez (1969) reported that grazing management producing 88 kg ha⁻¹ of beef caused a 211 kg ha⁻¹ reduction in grain production.

Very little research has been undertaken into the potential use of wheat as dual-purpose crop in Pakistan, therefore the present study was carried out to evaluate reduction in grain production under the cutting pressure.

MATERIALS AND METHODS

Experimental site

A field experiment was conducted at Agricultural Research Farm, NWFP Agricultural University, Peshawar, Pakistan. Peshawar is located about 1600 km north of Indian Ocean and thus has a continental climate. The experimental site is located at 34° N, 71.3° E and an altitude of 450 meters above sea level. The soil of the experimental field was silty clay loam with a clay type montmorillonite, low in nitrogen (0.03-0.04%), low in organic matter (0.7-0.9%) and alkaline in reaction (pH 8.0-8.2).

Experimental details

The experiment was laid out in randomized complete block design with three replications. Wheat variety Fakhre-sarhad was sown with the help of a seed drill on 10th November 2005 at seed rate of 100 kg ha⁻¹. A plot size of 5 x 1.8 m² with row to row distance of 22 cm was used. Nitrogen and phosphorus were applied at the rate of 100 and 90 kg ha⁻¹, respectively. Urea and single super phosphate were used as the sources for N and P, respectively. Urea was applied in three splits while SSP was applied all at sowing time. A cut was given to half of the plots as per treatments about 60 days after sowing. At the time of cut, the crop was at jointing stage and was ready to be used as fodder. Fresh and dry weight of the cut portion of the crop was recorded. The Warsak river canal was closed for desiltation at the time of cut therefore the field was not irrigated immediately after cut. However, the field was then irrigated after one month of taking cut. Weed density was recorded 100 days after sowing by using the quadrat having size 0.5 x 0.5 m². The fodder was sold at the rate of Rs.20000 ha⁻¹ while the grains of wheat were sold at the rate of Rs.11 kg⁻¹. The wheat straw yield was determined by subtracting grain yield from biological yield of wheat. The wheat straw was sold at the rate of Rs. 2 kg⁻¹.

STATISTICAL ANALYSIS

The data were statistically analyzed using analysis of variance appropriate for randomized complete block design. The treatment means were compared using LSD test at 0.05 level of probability, when the F-values were significant (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Weeds density (m⁻²)

Data revealed that there was a wide difference in weeds density in the cut and non-cut plots. Weed density was greater (146 m⁻²) in cut plots as against 37 m⁻² in no-cut plots. It was observed that weed density was four times greater than non-cut plots. The present findings revealed that in non-cut plots, wheat suppressed the weeds while in cut plots weeds germinated in late fall and flourished in the absence of competition with wheat crop plants. These findings also confirmed that weeds are not only problem for early wheat sowing but can also become a problem in late sown wheat. Weeds recorded during the course of experiment were *Avena fatua*, *Convolvulus arvensis*, *Melilotus indica*, *Medicago denticulata*, *Coronopus didymus*, *Anagallis arvensis*, *Rumex dentatus* and *Fumaria indica*.

Number of spikes m⁻²

Data regarding spikes m⁻² are presented in Table 1. Perusal of the data indicated that no cut plots produced significantly more spikes m⁻² (330) than the cut one (220). It may be due to the fact that the plots were cut at time of jointing stage therefore the cut plots did not produce any more tillers or even develop the already produced tillers due to the shock of cut. Similar results were reported by Arzadun *et al.* (2003) that spike density decreased linearly with increasing grazing pressure. These results are also in agreement with Simmonds (1989) who reported that in the cut treatment, recovery of growth in respect to tillers number varied greatly. In the early cut treatment, wheat varieties Kellalac and Rosella showed a decreased number of tillers after cutting.

Grains spike⁻¹

Analysis of the data (Table-1) revealed that no cut plots produced significantly more grains spike⁻¹ (50) as compared to the cut plots (45). It may be due to the long growth period availed by the uncut plots which enabled the crop to produce more grains spike⁻¹ as compared to the short growth period provided to the cut plots after cutting. Similarly the fast growing weeds rapidly infest the crop when the crop was given a cut and therefore produced less grains spikes⁻¹ as compared to non-cut treatment. Our findings agree with Khan *et al.* (2001) who also reported lesser grains spike⁻¹ in weedy check plots in wheat.

Thousand grain weight (g)

Perusal of the data (Table-1) indicated that the grains of no cut plots gained significantly more weight (35 g) as compared to the cut plots (31 g). It may be due the fact no cut plots received long growth period as compared the cut plots which enables the crop to deposit more assimilates in the sink and thus resulted in higher grain weight.

Grain yield (kg ha⁻¹)

Data regarding grain yield are reported in Table-1. Statistical analysis of the data showed that no cut plots produced more grain yield (3133 kg ha⁻¹) as compared to the cut plots (1858 kg ha⁻¹). The higher grain yield in the non cut plots may be due to the higher number of spike m⁻², more grains spike⁻¹ and heavy grain weight in the same plots which attributed toward higher grain yield. The results are similar with Benjamin *et al.* (1978) who reported that cutting of wheat reduced the yield by 56%. These results agree with Lyon *et al.* (2001) who stated that averaged across planting dates, grain yield was reduced compared with the full season control when wheat was harvested for forage at jointing. These results are consistent with Arzadun *et al.* (2003) who stated that grain yield was affected quadratically by grazing pressure, but difference between years was not significant.

Biological yield (kg ha⁻¹)

Data regarding biological yield are reported in Table-1. Statistical analysis of the data exhibited that no cut plots recorded significantly more biological yield (12121 kg ha⁻¹) as compared to the cut plots (7803 kg ha⁻¹). It may be due to the enhanced yield components in the same plots. Similarly the no cut plots shaded the weeds and shifted the competition towards the crop which led to more vegetative as well as reproductive growth as compared to the cut plots. Similar results were reported by Benjamin *et al.* (1978) who noted that grazing had no significant effect on the total production of the pasture but reduced the dry matter yield of wheat by up to 32%. These results are in line with Royo *et al.* (1999) who reported that clipping-induced decreases in pre anthesis dry weight and carbohydrate accumulation of triticale.

Economic analysis

Economic analysis of the data indicated that the income of the cut plots was a little higher than the income of the non-cut plots. Though the grain yield of the non-cut plots was significantly higher than the cut plots but the forage yield obtained from the cut plots fetched Rs.15000 ha⁻¹ which radically enhanced the income of the cut plots and thus brought the income of the cut plots at par with the income of non cut plots. Harvesting and grazing wheat may reduce economic risk; especially in an environment where hail, wind and drought frequently reduce grain yield. Grazing or harvesting the wheat as forage prior to the natural catastrophe would have provided economic value from the wheat that would not have been realized if grown only for grain (Lyon *et al.*, 2001).

Table-1. Effect of cutting on the following parameters of wheat.

Parameters	Cut	No cut	LSD	C.V.
Weeds m ⁻²	146	37	82.13	25.45
Plant height (cm)	89	99	5.65	1.70
Spikes m ⁻²	220	330	105.9	10.90
Grains spike ⁻¹	45	50	4.96	2.97

Thousand grain weight (g)	31	35	3.28	3.80
Grain yield (kg ha ⁻¹)	1858	3133	1041.3	11.87
Biological yield (kg ha ⁻¹)	7803	12121	1493.87	4.26

Table-2. Comparative incomes of cut and non-cut wheat.

Treatment	Grain yield Income (Rs.ha ⁻¹)	Forage yield Income (Rs. ha ⁻¹)	Wheat straw Income(Rs. ha ⁻¹)	Total income (Rs.)
Cut	20438	20000	11890	52328
Non Cut	34463	0	17976	52439

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