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CROP MANAGEMENT PRACTICES FOR DRY-LAND WHEAT

Riaz A. Khan, M. Azeem, Riaz A. Lalah and S. Ahmad*

The effects of seed treatment, methods of fertilizer placement and soil moisture conservation practices on the yield of two wheat cultivars were studied on a sandy loam soil under the 'Barani' farming conditions of Faisalabad. Soaking the seed of a drought resistant variety and placing N and P fertilizer 5.25 cm below the seed at sowing was found to be a more productive technology for the production of dry-land wheat. Soil moisture conservation by cultivation or stirring the top soil after each rain appeared to be a more efficient practice.

INTRODUCTION

Wheat is the staple food crop in Pakistan and is well adapted to a wide range of soil and climatic conditions. It is grown on 6.39 million hectares in this country (Mohammad, 1978). One-third of this area is under dry-land agriculture. Such rainfed areas mainly occur in Kohat, Bannu, Hazara, D.I. Khan districts and some parts of Peshawar, Mardan, Swat, Dir, Malakand and Chitral districts in N.W.F.P., Pothowar upland and parts of Gujrat and Sialkot districts as well as northern parts of Thal and Cholistan areas of the Punjab and southern parts of Thal desert in Sind. The annual rainfall in these areas ranges from about 203.2 to 1016.0 mm (Agri. Enquiry Committee, 1975). In these dry-land areas wheat yield is very low due to unproductive conventional farming practices and erratic rainfall during the growing season of the crop.

The characteristic problems in arid-zones are conservation and efficient utilization of available moisture and maintenance of soil fertility. Therefore, there is every need of introducing modern and the most suitable technology to ensure good crop yield by the use of drought resistant varieties and efficient utilization of fertilizer and available soil moisture in dry-land areas. With this objective in view, it was contemplated in these investigations to develop some effective measures for obtaining better emergence of wheat seedlings and more efficient method of fertilizer application and soil moisture conservation practices

Department of Agronomy, University of Agriculture, Faisalabad.

on a non-irrigated arable land receiving average rainfall of about 350±25 mm per annum.

REVIEW OF LITERATURE

Luebs and Laag (1964) characterised dry-land farming as crop production in areas where lack of moisture is a major limiting factor. They considered non-irrigated, arable lands receiving on an average 200 to 500 mm of precipitation as dry farming areas. They further stated that small grains, because of their characteristic growing season and drought tolerance, are the best adapted crops for dry-land agriculture.

Kelley (1971) reported that where ever the total amount of the distribution of rainfall is the principle factor of crop production, farming practices should emphasize on moisture conservation and maintenance of soil fertility.

Mjagkov (1952) pointed out that soaking seed before seeding had stimulatory effect on germinability, plant stand and yield particularly in dry-land areas.

Singh *et al.* (1976) concluded that application of phosphorus and nitrogen appreciably increased an extensive root system, plant growth and water use efficiency of wheat under dry farming conditions.

MATERIALS AND METHODS

A series of experiments were conducted at the Agronomic Research Farm, University of Agriculture, Faisalabad, during the two crop years ending in 1979. Summer rain moisture was conserved in the soil having a field capacity 17.92 per cent.

In the first experiment the effects of seeding dry and soaked seeds and methods of fertilizer placement on the germinability and yield of wheat varieties Pothowar and Sandal were studied. The seed was soaked for 24 hours before seeding on October 30, 1977 in replicated plots. The fertilizer treatments were, check, 56 kg P_2O_5, 112 kg N/ha applied at seeding by broadcast and by placement 5.25 cm below the seed. Split plot design with varieties in the main plots, fertilizer placement methods and seed treatments in first and second splits respectively, was employed.

In the second experiment, the effects of different moisture conservation practices vis-a-vis deep ploughing with a soil inverting plough, shallow ploughing with a cultivator, stirring the top soil with Bar harrow and fallowing were

studied. Moisture content of the top 30 cm soil were determined at various intervals during the growing period of the crop, especially after each rain. Wheat variety Lyallpur–73 was sown in the first week of November 1978. Each of the plot under moisture conservation treatment was split in two sub-plots. One of the plot was seeded with pre-soaked seed for 6 hours in water and the second was seeded with untreated seed. 56 kg each of N and P_2O_5/ha were applied at sowing.

RESULTS AND DISCUSSION

In Experiment I, the effect of seed soaking and method of fertilizer application were studied during 1977-78 on wheat cultivars grown under arid farming on a Faisalabad soil with a field capacity of 17.92 per cent. The average soil moisture content in the top 30 cm soil conserved from summer rains ranged from 9.12 to 9.72 per cent at seeding, while it varied from 10.53 to 10.71 per cent during the growing period of the crop. A natural precipitation of 83.2 mm was received from seeding to maturity of the crop.

Under these moisture stress conditions, Pothowar yielded 23.9 quintals/ha and out-yielded Sandal by 63 per cent (Table 1). Similarly, its straw yield was higher by about 55 per cent. The yield components of Sandal, a high potential variety under conditions of no moisture stress were suppressed more severely by the moisture stress suggesting that selection of a variety more adapted to drought is a must for obtaining high yield of dry-land wheat.

Soaking the seed before seeding stimulated faster emergence and seedling growth. This initial difference was maintained by the plants and resulted in significantly higher grain and straw yields over the conventional practice of seeding dry seeds (Table 1).

On an average, application of 56 kg P_2O_5 and 112 kg N/ha at seeding increased the grain yield over that of control by 6.8 quintals/ha. within the methods of fertilizer application, placement of N P, 5.25 cm below the seed gave 18 per cent higher yield than its broadcast application. Deeper fertilizer placement appeared to be a more efficient method to enable the plants to make use of the applied N P nutrient, especially in rainfed areas where moisture is available at a relatively greater depth. This observation is strengthened by the greater tillering and grain weight obtained by deeper fertilizer placement. The effects on yield were intensified when these treatments interacted. The results discussed above are also substantiated by matching harvest indices (Table 1).

Table 1. *Effect of varieties, seed soaking and fertilizer placement on the yield and harvesting index of wheat under dry-land agriculture.*

Treatment	Yield per hectare		
	I Grain (Quintals)	II Straw (Quintals)	III Harvesting index
Varieties			
Pothowar	23.91 a	37.42 a	38.68 a(1)
Sandal	14.58 b	24.21 b	37.48 b
Seed treatment			
Unsoaked	17.87 b	29.05 b	37.62 b
Soaked	20.62 a	32.58 a	38.53 a
Fertilizer application methods			
Check	15.36 c	27.49 c	35.64 c
Broadcast	19.43 b	31.26 b	38.27 b
Deep placement	22.89 a	33.71 a	40.32 a

(1) Duncan's Multiple Range Test at 5 per cent probability. Any two means within a column not sharing a letter in common differ significantly.

These observations suggest that soaking of the seed of a well adapted variety before seeding and placing the N P nutrients 5.25 cm below the seed generate relatively more favourable and balanced growth conditions for growing wheat on dry-land areas receiving annual rainfall of 373 mm including 83 mm during the growing period of the crop.

Experiment II

In this experiment, the effects of different methods of moisture conservation and soaking seed for 6 hours before seeding were studied during the year 1978-79. Deep ploughing with a furrow turning plough, shallow ploughing with a cultivator, stirring the top soil with a Bar harrow and no tillage after each summer rain were practiced. Total summer rain from June to October was 378 mm. The soil moisture content at sowing on November 6, was higher in all the tillage practices as compared to the plots where no soil conservation practice was followed (Table 2). This initial variation in soil moisture content

continued till about the middle of February, although the crop generally experienced moisture stress during this period. Thereafter, due to unprecedented winter rains of 201 mm, 70 per cent of which was received in February and March, differences in the soil moisture reserve generally disappeared for the next one month and ranged from 11 to 14 per cent. Consequently any initial differences in crop growth due to variation in soil moisture conservation practices were made up and similar grain yields were obtained (Table 3). It is, however, interesting to observe that variation in soil moisture reserve, where cultivation and stirring top soil were followed to conserve moisture, was more uniform and relatively higher moisture content was maintained over a longer period as compared to deep ploughing and fallowing. These observations suggest that on sandy loam soil, deeper cultivation for moisture conservation may not be more efficient or economical practice.

Table 2. *Effect of different tillage practices on soil moisture content in the top 30 cm soil during growth of wheat.*

Date of sampling	*Soil moisture percentage*			
	Deep ploughing	Shallow ploughing	Stirring top soil	Fallow
6.11.78(1)	7.53	7.36	7.49	6.47
12.12.78	6.47	7.08	7.35	6.61
6.2.79	8.60	8.12	8.61	7.82
17.2.79	8.63	9.37	9.92	7.18
20.2.79	14.01	14.18	14.51	14.62
3.3.79	10.82	12.00	12.70	12.20
7.3.79	12.37	11.83	11.37	11.21
17.3.79	11.22	11.71	12.14	11.47
4.4.79	9.12	11.57	11.30	9.92
19.4.79(2)	7.48	6.76	7.39	7.31

(1,2) At sowing and harvesting respectively.

Soaking of seed before seeding has once again demonstrated its superiority over the conventional practice of dry seeding of wheat under 'barani' farming (Table 3). A grain yield of 16.3 quintals/ha was obtained by soaking the seed for 6 hours before seeding as compared to 15.2 quintals/ha from the unsoaked seed. This is equal to the national average from the irrigated wheat.

Table 3. *Effect of seed treatment and different soil moisture conservation practices on the yield of wheat under 'barani' farming.*

Seed treatment	Grain yield quintals/ha.
Soaked in water for 6 hours	16.26 a(1)
Unsoaked	15.25 b
Conservation practices:	
Deep ploughing	15.36
Shallow cultivation	15.33
Stirring top soil	15.91
Fallowing	16.43 NS(2)

(1) Duncan's Multiple Range Test at 5 per cent probability. Any two means not sharing a letter in common differ significantly.

(2) Non-Significant.

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