Crop Straw Incorporated as a Strategy to Prevent Burning Straw Residues

Hossein Sadeghi

Abstract**—** Iranian farmers are looking to straw incorporation as a strategy for improving soil organic matter management and allaying public concerns over the impacts of straw burning on air pollution. A 2-years field study was carried out to evaluate the influence of crop residues management and nitrogen (N) rates on dryland barley. The experiment was conducted as strip split plot with four replications. Horizontal plots were three crop residues rates (0, 750 and 1500 kg ha^{-1}), vertical plots consisted of two dryland current barley cultivars (CVs) (Afzal and Reyhan), and sub-plots were three N rates (0, 40, and 80 kg N ha^{-1}). Number of spike per plant, grains per spike, The optimum crop growth and the highest grain yield was achieved from the highest crop residues and N rates, indicating that the most reliable system for dryland barley production in the region is complete residues incorporation into the soil following disking, seeding with chisel seeder and application of 80 kg N ha^{-1}. The objective of this research is evaluation and effects of straw management and N rates on dryland barley.

Keywords**—** straw management, Dryland barley, CO_2 emission

I. Introduction

IN most regions of Iran, cereal straw have been traditionally burned or removed; that is often criticized for soil organic and nutrient losses, reducing soil microbial activity and increasing CO_2 emission. Whereas, crop residues incorporation can improve soil quality and reduce air pollution on a long term basis (1,2,5,6).However, where residues have been soil incorporated, farmers often have concerns for reduced soil fertility from nutrient immobilization and problems for cultivation associated with slow rates of residues decomposition (3). Where residue have been incorporated before planting the next crop, grain yield was lower than where residues were removed or burned, resulting in N immobilization (1,6). The most influencing factor on wheat yield is N fertilization, although the degree of influence is governed principally by weather conditions and residual soil N (3). Burning is increasingly being looked on as an unacceptable residue management practice because of the additional CO_2 and particulate matter that is expelled into the atmosphere upon combustion of crop residues. Agricultural soils can however actually serve as a significant C sink, rather than a C source, at least until the maximum capacity to store C is achieved, if improved residue management and reduced tillage systems are adopted (4). Therefore, alternative residue management options must be developed to minimize or eliminate the tradition of residue burning and reduce soil respiration. There is not enough information on the effects of straw management and N rates on dryland barley in southern part of Iran, where more than 120,000 ha of this crop is nearly grown as continuous cropping.

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II. Material And Methods

The experiment was conducted as strip split plot with four replications. Horizontal plots consisted of three crop residues rates (0, 750 and 1500 kg ha^{-1}), vertical plots were two dryland current barley cultivars (CVs) (Afzal and Reyhan), and sub-plots were three N rates (0, 40, and 80 kg N ha^{-1} as urea). Half of the N was applied at planting time and the other half during the tillering stage and before the end of spring rainy season. Plots were 6 × 8 m. barley was sown about early -October of each year before the rainy season (Fig1.) The experimental site has been previously sown with winter dryland barley to determine the potential yield and to provide residue cover for the plot, and the experiment started in cropping year of 2007 and continued through 2009. Seed-beds were prepared by disking, and wheat residues were spread over the plots before seeding (4). Seeds were sown in 22 cm row width with chisel seeder (150 kg ha^{-1}).

III. Results And Discussion

Grain yield, grains per spike and biological yield significantly increased with increased N rates. The variation trend of different N rates at 0 kg N ha^{-1} crop residue showed that yield and yield components significantly increased by increasing N rates in both CVs. The optimum crop growth and the highest grain yields (1459 and 1057 kg ha^{-1} in Afzal and reyhan, respectively) were obtained at 1500 kg ha^{-1} crop residue rate and 80 kg N ha^{-1} (Table1.).

The lowest grain yield and yield components were achieved from 1500 kg ha^{-1} residue incorporation into the soil without N application in both CVs in both years, indicating the soil N imbalance due to the slower residue decomposition. Positive correlation coefficients were observed between grain yield and number of spikes per plant, grains per spike, grains per plant, biological yield and harvest index . Barley straw and N rates, generally increased spikes per plant, grains per spikes, 1000-grain weight, grain yield, biological yield and harvest index. Grains per spike and harvest index significantly increased with increased barley crop residue rate.

Grains per plant, number of grains per spike, spikes per plant, and 1000-grain weight significantly increased with increased N and residue rates in both CVs in both years. When the highest crop residues were incorporated into the soil, but N rate was inappropriate, grain yield and yield components significantly decreased in both years. The optimum crop growth and the highest grain yield were achieved at 1500 kg crop residues ha^{-1} and 80 kg N ha^{-1}.(table1.).

carbon levels which contribute to improved soil quality and productivity, and increased efficiency of carbon sequestration into the soil. However Reinertsen, et al., (7) reported that increased crop residues rates did not influence soil organic carbon.

IV. Conclusion

The optimum crop growth and the highest grain yield were achieved at 1000 kg crop residues ha-1 and 70 kg N ha-1, indicating that complete residue incorporation accompanied by application of 70 kg N ha-1 (half at planting and half at the tillering stage) is the most reliable system for dryland wheat production in the region.

Number of fertile spike per plant, grains per spike, grains per plant and 1000-grain weight significantly increased with increased N and residue rates in both CVs in both years. When the highest crop residues were incorporated into the soil, but N rate was inappropriate, grain yield and yield components significantly decreased in both years

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Fig 1. Creating straw incorporated

Table I
Coefficient Correlation Matrix Between Grain Yield And Yield Components Of Two Barley Cultivars

	Grain yield	Fertile Spike	Grains per spike	1000-grain weight	Biological yield
Spikes per plant	0.511 *				
Grains per spike	0.582 **	0.033			
1000-grain weight	0.213	- 0.242	- 0.121		
Biological yield	0.868 **	0.709 **	0.479 *	0.969 **	
Harvest index	0.608 **	- 0.617	0.483 *	0.178	0.175

* and ** significant at 0.05 and 0.01 probability level, respectively.