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A STUDY ON THE INTERRELATIONSHIPS BETWEEN UPPER PLANT FOLIAGE AND GRAIN YIELD IN WHEAT

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The effect of photosynthetic structures including those above the flag leaf node on grain yield in wheat was ascertained on the basis of average yields obtained after the removal of these structures at different stages. The varieties used were LU26S, Bahawalpur79, WL711, Sandal, PAR173 and two new strains, 1407–1 and 1407–5. The results seemed significant as the removal of plant leaves in different combinations with awns ended in marked yield reductions. Of these, the flag leaf had the highest effect on the grain yield potential, rising to the extent of 50%. The varietal differences were not much pronounced.

INTRODUCTION

Foliar surface and leaf canopy patterns are known to have a definitive effect on the development of yield potential in wheat. Reduction of foliar surface due to disease or physiological stress is reflected to a varying degree in the yield performance of the crop. Similarly, pleiotropic effects of awns in wheat have also been reported, though there is little information available on the degree of combined effect of awns and foliage oy yield.

High positive correlations were reported by Saha *et al.* (1980) between total photosynthetic area above the flag leaf node (comprising leaf sheath, flag leaf, peduncle and head) and grain yield per spike in wheat. A further partitioning of the effects as attributable to these components showed that the peduncle had little influence on grain yield. Hsu and Walton (1971) reported similar results and found that flag leaf blade breadth and sheath had an edge over other related structures in the matter of affecting grain yield. Also, the studies of Singh, Singh and Sharma (1980) and Olugbemi, Austin, and Bingham (1976) in wheat provide evidence of a positive relationship between photosynthetic structures above the flag leaf node and grain yield.

The present studies had two-fold objectives : (i) to ascertain the effect of forced partial leaf shedding on 4 varieties of wheat, namely, LU26S, Bahawalpur79, WL711 and Sandal, and (ii) to estimate a consequent drop in yield caused by the loss of awns and/or flag leaf in the varieties, PAR173, LU26S, 1407-1 and 1407-5.

MATERIALS AND METHODS

For the purpose of relating reduction in grain yield to loss of foliage the following treatments were applied :

T_0 : control (no defoliation)
T_1 : lower three leaves removed
T_2 : upper three leaves excluding flag leaf removed
T_3 : flag leaf removed
T_4 : all leaves except the flag leaf aemoved

The characters measured in this experiment included (i) Plant height (ii) spike length (iii) number of spikelets per spike (iv) number of grains per spike (v) 1000-kernel weight and (vi) yield per plant.

For the second part of the study concerning adverse effect of removal of the awns and/or flag leaf of the wheat plant, the treatments consisted in (i) on awns (ii) no flag leaf and (iii) neither awns nor flag leaf retained.

Analysis of variance was run on the experimental data and the relevant statistics are presented in Tables 1 and 2.

RESULTS AND DISCUSSION

Clipping of awns showed a significant drop in yield compared to control in all the genotypes included in the study showing comparable patterns of yield decline on removal of awns and flag leaf separately and in combination. Averaged over varieties and replications, the yield per spike came to be 2.5 gm (control), 2.10 gm (without awns), 2.01 gm (without flag leaf), and 1.83 gm (without awns and flag leaf). Further details could be perused in Table 1.

Disposal of the flag leaf and awns independently of each other caused significant yield reductions and the level of reduction in both cases was almost equal. However, the removal of the awns and tud flag leaf together had a more significant effect and caused a greater yield reduction (27%). This treatment

Table 1. *Effect of flag leaf and awns on the grain yield (gm) per spike of four wheat varieties*

	PARI 73				LU26S				1407-1				1407-5			
	Without awns	Without awns and flag leaf	Without flag leaf	Control	Without awn	Without awns and flag leaf	Without flag leaf	Control	Without awns	Without awns and flag leaf	Without flag leaf	Control	Without awns	Without awns and flag leaf	Without flag leaf	Control
R_1	2.99	2.45	2.81	3.23	2.20	2.06	2.24	2.97	2.03	1.65	1.99	2.35	2.73	1.95	1.66	2.45
R_2	2.47	2.01	2.18	2.99	2.25	2.21	2.51	2.92	2.03	1.77	2.04	3.17	2.18	1.87	2.25	2.30
R_3	2.16	1.79	2.25	2.46	2.22	2.02	2.30	2.15	1.46	1.33	1.48	1.75	1.79	1.45	1.71	2.35
R_4	1.72	1.49	1.29	2.41	1.76	1.73	1.87	2.54	1.93	1.41	1.70	2.13	1.68	2.16	1.89	1.96
Total	9.34	7.74	8.53	11.09	8.43	8.02	8.92	10.58	7.45	6.16	7.21	9.40	8.38	7.43	7.51	9.06
Avg.	2.33	1.93	2.13	2.77	2.11	2.00	2.23	2.64	1.86	1.54	1.80	2.35	2.09	1.86	1.88	2.65

ANOVA

S.O.V.	D.F.	S.S.	M.S.	F.R.
Replications	3	3.36	1.12	6.59*
Varieties	3	1.74	0.58	3.41^{NS}
E_1	9	1.55	0.17	
Treatment	3	3.91	1.30	23.70**
V x Tr	9	0.40	0.044	0.81^{NS}
E_2	36	1.97	0.055	
Total	63	12.93		

Treatment	Mean	Stat.Sig
Control	2.51	a
Without awns	2.10	b
Without flag leaf	2.01	b
Without awns and flag leaf	1.83	c

* = Significant, ** = Highly significant
NS = Non-significant.

had significantly the lowest yield of all the treatments, The results suggested that the two appendages, namely awns and flag leaf, might be directly linked with grain yield in wheat and any serious mishandling of them causing injuries is likely to reduce their efficiency and lead to significant yield losses.

Table 2. *Effect of foliar canopy on various characters averaged over varieties/treatments.*

Varieties/ Treatments	Plant height (cm)	Spike length (cm)	No. of spikelets	No. of grains per spike	1000-grains weight (gm)	Yield per plant (gm)
LU26S	96.18	13.87	21.50	70.75	42.25	9.42
WL 711	94.25	14.97	22.96	85.60	39.73	9.57
Bahawalpur79	92.61	15.49	23.28	85.79	36.39	8.86
Sandal	93.14	14.59	23.07	86.33	38.10	9.48
T_0	94.72	15.20	23.15	86.99	50.41	12.71
T_1	94.48	14.56	22.53	82.80	48.85	11.48
T_2	93.91	14.48	22.68	80.36	47.55	10.48
T_3	93.20	14.56	22.62	79.18	24.78	6.12
T_4	93.88	14.75	22.53	78.14	24.00	5.87

Furthermore, it may be observed from the data presented in Table 2 that flag leaf played a significant role in the development of grain yield and accounted for more than 50 per cent yield reduction when removed alone. Conversely, it can be argued that the flag leaf contributed 50 per cent to the total grain yield potentiol. Injury to the basal leaf seemed relatively of little account as it caused less damage compared with the upper leaves. These studies also provided evidence of a differential response of varieties as reflected in a varying degree of leaf damage, which fact suggests a possible genetic basis for tolerance to such losses. It would appear that the information reported in this study has value in designing ideotypes for high, stable yields in wheat.

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