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# Improving the Selection Efficiency of New Wheat Genotypes Based on the Combined Analysis

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**Abstract:** 85 new wheat selections were assessed and compared with the three standard local checks based on the combined analysis in five preliminary wheat yield trials. The combined analysis has the advantage by improving the selection efficiency of the new genotypes tested in different yield trials conducted in the same year and location. Seven out of the total selections tested out yielded the standard check varieties after making the adjustments in the treatment means. This analysis gave an equal chance to the new selections tested in the different trials which otherwise may have been overlooked.

**Key words:** Combined analysis, Selection efficiency, Wheat, Preliminary Yield Trials

## Introduction

Varietal development involves a number of steps starting from hybridization and then to fix the homozygosity and after that realizing the yield potential of the newly developed genotypes in the form of yield trial/trials. The normal procedure is to assess the new selections while making comparisons with one or more standard checks. If there are limited number of selections, then these are tested in one trial but if the number of selections is more which usually is, then they are put in different preliminary trials with the same standard checks in each trial. Although the number of entries in each trial is the same but are always genetically different. The advantage in this system is that quite a number of new selections are assessed in the trials but the main disadvantage is that performance of the new selections cannot be compared between the trials (Peterson, 1986). Information on pooled analyses is available on the series of experiments (Miller *et al*., 1959; Sinha *et al*., 1962) however, very little information is available on the combined analysis (Iftikhar *et al*., 1992). This paper presents a combined analysis of five preliminary wheat yield trials conducted on one location in a given year.

## Materials and Methods

Five preliminary advance line wheat yield trials were planted at National Agricultural Research Centre, Islamabad (Longitude 73.08 E and Latitude 33.42 N) under rainfed conditions during the year 1997-98. Each trial consisted of twenty entries planted in a randomized complete block design. The plot size was kept as 6 rows of five meter length with 25 cm row to row distance. Final harvest was made from central four rows of 5 m length from each plot (5 $m^2$ net area harvested). Fertilizer was applied at 80:80:0 NPK. All other common cultural practices were done to make the plots free from weeds etc. Total precipitation received during the crop season was 543 mm. Meteorological data for the crop growth period is presented in Fig. 1. This year was considered favourable for the wheat crop.

In each trial there were three commercial wheat varieties viz Chakwal-86, Rawal-87 and Ingelab-91 used as checks. The rest of the entries (17) were new selections and were different in each trial. After harvest yield data were recorded on each plot and were subjected to combined analysis. The steps and procedures to analyze the data and making comparisons are taken as suggested by Peterson (1986). Data on other morphological traits like plant height, days to heading and days to maturity were also recorded. Analysis of variance of each yield trial (new selections only) were done separately and selection means were adjusted after doing the pooled analyses of variance of the three common checks. The least significant increases (LSI) and the differences between adjusted means of the new selections in the same and different trials were also computed.

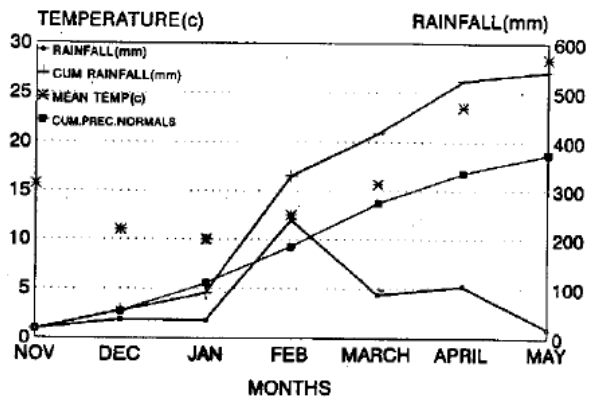


Fig. 1: Precipitation normals are average of 30 years (1961-1990)

## Results and Discussion

The combined analysis of variance of the three standard wheat checks (Rawal-87, Chakwal-88 and Inqalab-91) in the five preliminary yield trials is presented in Table 1 and of the 17 new selections tested in each trial is presented in Table 2. The adjustment factor was calculated from the difference between grand mean and the trial mean of the

Table 1: Analysis of variance of yields of three standard wheat varieties from five preliminary yield trials conducted during 1997-98

| Source | d.f | SS | MS | Probability |
|---|---|---|---|---|
| Replication | 14 | 374577.8 | | |
| Trial | 4 | 1096888.9 | 274222.2 | 0.6 |
| Replication in trial | 10 | 2648888.9 | 264888.9 | 0.58 |
| Varieties | 2 | 878111.1 | 4355.6 | 0.001 |
| Error | 28 | 12872888.8 | 459748.0 | |
| Total | 44 | 16705777.8 | | |

Table 2: Analysis of variance of yields of new wheat selections from five preliminary yield trials

| | | Sum of Squares | | | | |
|---|---|---|---|---|---|---|
| Source | d.f | Trial1 | Trial2 | Trial3 | Trial4 | Trial5 |
| Rep | 2 | 3530980.4 | 673049.8 | 366739.9 | 1463059 | 3733943.00 |
| Selection | 16 | 12876862.8 | 16825912.0 | 12729985.0 | 10000340 | 10925869.00 |
| Error | 32 | 13669019.6 | 10634530.0 | 8926608.0 | 12224680 | 4842703.00 |
| Total | 50 | 30076862.8 | 2813349.0 | 22023333.0 | 23688080 | 19502514.00 |

Table 3: Check yields (kg/ha), means and adjustment factors for five wheat trials

| | | Checks | | | | | |
|---|---|---|---|---|---|---|---|
| Trial | Block | Chakwal-86 | Rawal-87 | Inqalab-91 | Total | Mean | Aduj Fac |
| 1 | 1 | 3600 | 3600 | 3000 | 10200 | | |
| | 2 | 4200 | 4000 | 3000 | 11200 | | |
| | 3 | 3000 | 3000 | 4800 | 10800 | | |
| | Sum | 10800 | 10600 | 10800 | 32200 | 3577.78 | -40.00 |
| 2 | 1 | 4000 | 4200 | 2800 | 11000 | | |
| | 2 | 4000 | 4400 | 3200 | 11600 | | |
| | 3 | 3800 | 3000 | 4600 | 11400 | | |
| | Sum | 11800 | 11600 | 10600 | 34000 | 3777.78 | 160.00 |
| 3 | 1 | 3400 | 3200 | 2800 | 9400 | | |
| | 2 | 3200 | 4000 | 3400 | 10600 | | |
| | 3 | 3000 | 3000 | 4000 | 10000 | | |
| | Sum | 9600 | 10200 | 10200 | 30000 | 3333.33 | -284.44 |
| 4 | 1 | 2000 | 3600 | 3800 | 9400 | | |
| | 2 | 4600 | 4200 | 3800 | 12600 | | |
| | 3 | 3400 | 3400 | 4600 | 11400 | | |
| | Sum | 10000 | 11200 | 12200 | 33400 | 3711.11 | 93.33 |
| 5 | 1 | 3000 | 3400 | 4200 | 10600 | | |
| | 2 | 4400 | 3200 | 3000 | 10600 | | |
| | 3 | 4200 | 3600 | 4200 | 12000 | | |
| | Sum | 11600 | 10200 | 11400 | 33200 | 3688.89 | 71.11 |
| | Total | 53800 | 53800 | 55200 | 162800 | | |
| | Mean | 3586.67 | 3586.67 | 3680.00 | 3617.78 | 3617.78 | |

Table 4: Means and adjusted means of five preliminary wheat yield trials conducted during 1997-98

| PYT1 | | PYT2 | | PYT3 | | PYT4 | | PYT5 | |
|---|---|---|---|---|---|---|---|---|---|
| Mean | Adj.Mean* | Mean | Adj.Mean | Mean | Adj.Mean | Mean | Adj.Mean | Mean | Adj.Mean |
| 3266.7 | 3306.7 | 3933.3 | 3773.3 | 3000.0 | 3284.4 | 3000.0 | 2906.7 | 3733.3 | 3662.2 |
| 4200.0 | 4240.Oab | 4066.7 | 3906.7 | 2866.7 | 3151.1 | 4600.0 | 4506.7ab | 3866.7 | 3795.6 |
| 3400.0 | 3440.0 | 2933.3 | 2773.3 | 2933.3 | 3217.8 | 3266.7 | 3173.3 | 4025.7 | 3954.6 |
| 3800.0 | 3840.0 | 3066.7 | 2906.7 | 3266.7 | 3551.1 | 3266.7 | 3173.3 | 3200.0 | 3128.9 |
| 4133.3 | 4173.3 | 3333.3 | 3173.3 | 3266.7 | 3551.1 | 3800.0 | 3706.7 | 3400.0 | 3328.9 |
| 4200.0 | 4240.0ab | 3466.7 | 3306.7 | 3333.3 | 3617.8 | 4200.0 | 4106.7 | 3466.7 | 3395.6 |
| 4066.7 | 4106.7 | 3866.7 | 3706.7 | 2266.7 | 2551.1 | 3933.3 | 3840.0 | 4025.7 | 3954.6 |
| 3600.0 | 3640.0 | 2333.3 | 2173.3 | 2044.3 | 2328.8 | 3533.3 | 3440.0 | 4000.0 | 3928.9 |
| 2466.7 | 2506.7 | 3666.7 | 3506.7 | 3812.7 | 4097.1 | 3866.7 | 3773.3 | 3266.7 | 3195.6 |
| 3466.7 | 3508.7 | 3200.0 | 3040.0 | 3000.0 | 3284.4 | 3600.0 | 3506.7 | 2866.7 | 2795.6 |
| 3400.0 | 3440.0 | 2600.0 | 2440.0 | 2866.7 | 3151.1 | 3031.3 | 2938.0 | 4000.0 | 3928.9 |
| 4200.0 | 4240.Oab | 2987.7 | 2827.7 | 3200.0 | 3484.4 | 3666.7 | 3573.3 | 2733.3 | 2662.2 |
| 4400.0 | 4440.0ab | 4266.7 | 4106.7ab | 4333.3 | 4617.8 | 4000.0 | 3906.7 | 3933.3 | 3862.2 |
| 4133.3 | 4173.3 | 3200.0 | 3040.0 | 2933.3 | 3217.8 | 3600.0 | 3506.7 | 2533.3 | 2462.2 |
| 3533.3 | 3573.3 | 2333.3 | 2173.3 | 3000.0 | 3284.4 | 4133.3 | 4040.0 | 3666.7 | 3595.6 |
| 4533.3 | 4573.3ab | 2933.3 | 2773.3 | 3133.3 | 3417.8 | 3533.3 | 3440.0 | 3266.7 | 3195.6 |
| 3666.7 | 3706.7 | 3933.3 | 3773.3 | 3400.0 | 3684.4 | 3400.0 | 3306.7 | 3266.7 | 3195.6 |

LSI 5% = 594

a = Significantly higher than Chakwal-86 and Rawal-87 with mean yield = 3586.67

b = Significantly higher than Inqalab with mean yield = 3680

a = Adjusted mean

PYT = Preliminary Yield Trial

Table 5: Parentage of the 7 highest yielding new selections in five preliminary yield trials (1997-98)

| Parentage | Source No. | Yield Kg/ha |
|---|---|---|
| Kauz/CMH77.308//Bau | Pyt1-3 | 4240 |
| Kauz/Star | Pyt1-7 | 4240 |
| Pastor/Opata | Pyt1-14 | 4240 |
| Pastor*2/Opata | Pytl-15 | 4440 |
| Ures/Jan/Kauz | Pyt1-18 | 4573 |
| ESDA/VEE#10 | Pyt3-15 | 4618 |
| Bow//Buck/Bul | Pyt4-3 | 4506 |
| Local Check 1 (Ingelab-91) | - | 3680 |
| Local Check 2 (Rawal-87) | - | 3587 |
| Local Check 3 (Chakwal-86) | - | 3587 |

checks (Table 3). The means and adjusted mean yields of the new selections (a total of 85 in 5 trials) is given in Table 4. The least significant increase (LSI), one sided was also computed as 594 kg to determine which of the new selections significantly out yielded the local checks. The analysis of variance of the check varieties revealed that checks were significantly different at 5 percent level of probability. Check varieties Rawal-87 and Chakwal-86 had the same mean yield while Ingelab-91 had significantly higher grain yield compared to these two varieties. While considering the results in Table 4, it was observed that only 7 out of 85 selections tested in 5 trials significantly out yielded the three checks after making adjustments for mean differences in the trials. The parentage and yield data regarding these 7 selections is given in Table 5.

The real advantage or benefit from the combined analysis techniques seems to be worthwhile adjustments made in the new selection means. The same checks are combined over the trials and the overall mean of each check is compared while selecting the new lines and this way equal chance is given to the new selections which otherwise may have been overlooked if each trial check is considered separately. Therefore selecting new genotypes by using combined analysis may represent the better adaptability of these lines under the target environment and show outstanding performance as compared tot he selections made using individual trial analysis.

## References

Iftikhar, A., Z. Ahmed, Z. Mustafa, S. Masood and N.I. Hashmi, 1992. Yield assessment of advance wheat selections based on combined analysis. Sarhad J. Agric., 8: 399-403.

Miller, P.A., J.C. Williams and H.F. Robinson, 1959. Variety × environment interactions in cotton variety tests and their implications on testing methods. Agron. J., 50: 132-134.

Peterson, R.G., 1986. Combined analysis of on-station yield trials. Rachis, 5: 1-8.

Sinha, P., P.B. Bhattacharya and M.P. Sinha, 1962. Manurial experiments on cultivars field paddy in Bihar, India. IRC Newslett., 11: 1-18.