

NARC-2009: A HIGH YIELDING WHEAT VARIETY FOR RAINFED AREAS OF PAKISTAN

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ABSTRACT: Wheat breeding efforts conducted at NARC, Islamabad have resulted in the development of a wheat variety suited for rainfed areas of Pakistan. NR-268 was selected from an exotic germplasm nursery (INQYT 2003-04) received from CIMMYT, Mexico. It was evaluated for five years in different trials. It was first tested in advance yield trial conducted at NARC, then in Micro Yield Trials conducted at nine locations by BARI, Chakwal and finally it was evaluated in National Uniform Yield Trials conducted in rainfed ecology of Pakistan for two consecutive years. The NR-268 performed better than all other lines including local check and gave 21.5% higher grain yield than check in Punjab and 8.3% higher yield on overall country basis during 2005-06; whereas, during 2006-07 it gave 26% higher grain yield than check in Punjab and 10.18% higher yield on overall country basis under rainfed conditions. On station agronomic trials of the line were also carried out. The variety possesses desirable characteristics such as resistance against yellow and leaf rust and also good quality. Spot examination of the line was conducted on March 24, 2009 and also recommended by experts of sub-committee of Punjab Seed Council in a meeting held at AARI, Faisalabad. The variety case was presented in Punjab Seed Council meeting and was approved as a commercial variety namely NARC-2009 for cultivation in rainfed areas of Pakistan.

Key Words: Wheat; Variety; Rainfed Areas; High Yielding; Pakistan.

INTRODUCTION

In Pakistan, wheat being the staple food of the masses is the most important crop. During 2008-09, the crop was grown on 9.062 million hectares and the size of the crop was 24.03 million tonnes with an average yield of 2651 kg ha⁻¹ (Anonymous, 2009a). Moreover, it contributes 12.7% to the value added in agriculture and 2.6% to GDP. Over the past three decades, increased agricultural productivity has been largely achieved due to the deployment of high-yielding cultivars (Norman, 1965). With the introduction of semi-dwarf wheat cultivars, wheat yield has increased in all the major cropping systems representing diverse agro-ecological conditions. Wheat production in the country; however it is well below potential and variable. Therefore, chorological development of varieties, resistant to prevalent stresses for the target environment is required.

The area and production of wheat crop increased as compared to 2007-08 by 5.8% and 14.7%, respectively. The area for wheat production increased due to timely announced attractive support price and vigorously launched "Grow More Wheat" campaign by the Government. This encouraged the growers to put more area under wheat crop. Adequate soil moisture at the time of sowing and favourable weather conditions (Anonymous, 2009b) are important for increased crop yield.

Drought and rusts (leaf rust and yellow rust) are the major stresses in rainfed areas of Pakistan which causes 30-40% losses. Therefore varieties with diverse sources of resistance and adaptation are needed for *barani* area to exploit the potential yield and increase wheat production in the country.

Since significant genotype x environment (G x E) interaction has been observed

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in the national trials during the recent years, thereby specific location effects can be realized through the release of this variety in a particular niche. Before the release of variety (NARC-2009), presently only two wheat varieties (Chakwal-50 and GA-2002) were available to farmers for rainfed areas. The release of this new variety will complement the existing diversity and the farmers can make decision to choose and pick the higher yielding variety with resistance against rusts. In this way, the individual farmer will gain the optimum benefit.

MATERIALS AND METHODS

NR-268, a cross of Inqalab 91*2/Tukuru was received from CIMMYT, Mexico during 2003-04 (Anonymous, 1984). It was first evaluated INQYT during 2003-04 by using Inqilab-91 and Wafaq-2001 as local check with 11% coefficient of variation. The layout of the experiment was randomized complete design with four replications. During 2005-06, it was evaluated in advance yield trials using alpha lattice design, by using Wafaq-2001 as local check. It was promoted to Micro Varietal Yield Trial conducted by BARI, Chakwal at nine sites during 2006-07 in rainfed ecology by using GA-2002 as local check. It was tested in National Uniform Yield Trials for rainfed during 2005-06 and 2006-07 at 17 sites of Pakistan by using randomized complete design with four replications. The line (NR-268) was also evaluated by CDRP during 2005-06 and 2006-07 for disease reactions. Agronomic trials for seed rate and sowing date were also conducted in 2007-08 by using split plot design. The recommended agronomic practices were applied in all trials. Data recorded were analyzed by following standard statistical methods (Steel and Torrie, 1984). Quality characteristics of the line were also evaluated.

RESULTS AND DISCUSSION

NR-268, a cross of Inqalab- 91*2/Tukuru was received from CIMMYT,

Mexico during 2003-04. It was first evaluated INQYT. During 2005-06, it was evaluated in advance yield trials. It was then promoted to Micro Varietal Yield Trial in rainfed ecology. It was tested in National Uniform Yield Trials rainfed during 2005-06 and 2006-07.

Preliminary and Advance Yield Trial

During 2003-04, NR-268 gave 20% and 27% higher yield than two local checks (Inqalab-91 and Wafaq-2001) in station trial, INQYT (Table 1). In Advance Yield Trial conducted at NARC by using alpha lattice design, the newly-evolved line gave 3% higher yield than local check (Wafaq-2001).

Table 1. Performance of NR-268 at different station trials (kg ha⁻¹)

Parameter	2003-04	2005-06	2006-07
Trial	INQYT	AYT#2	MVYT
NR-268	4694	3341	3786
Local Checks			
Inqalab-91	3709	-	-
Wafaq 2001	3912	3252	-
GA 2002	-	-	3222
% increase over			
Inqalab-91	27	-	-
Wafaq 2001	20	3	-
GA 2002	-	-	18

In Micro Varietal Yield Trial conducted at nine sites by using randomized complete block design during 2006-07 of rainfed ecology by BARI, Chakwal, the NR-268 gave average 18% higher yield than local check (GA-2002).

National Uniform Yield Trials

NR-268 performed better than all other lines including local check in National Uniform Yield Trials during 2005-06 and gave 21.5% higher grain yield than check in Punjab and 8.3% higher yield on overall country basis under rainfed conditions at 17 sites (Mustafa et al., 2006). In National Trial conducted at 17 sites of Pakistan during 2006-07, it gave 10.18% higher yield (Table 2) than local check on all Pakistan basis (Mustafa et al., 2007).

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Table 2. Yield data of NR-268 in NUWYT(RF)

Parameter	Punjab (9-Sites)	Pakistan (17-Sites)	
2005-06			
NR-268	3227	3494	
Local Check	2656	3226	
Grand Mean	2864	3350	
C.V (%) :	15.1	14.7	
LSD (0.05):			
Location	173.9	413	
Variety	200.5	166	
LxV	-	**	
%Increase over			
Local Check	21.5	8.3	
2006-07			
	Punjab (8-Site)	Balochistan (2-Sites)	Pakistan (17-Sites)
NR-268	4162	1459	3787
L. Check	3301	1116	3437
Grand Mean	80	1216	3576
C.V (%) :	11.2	19.3	14
LSD (0.05):			
Locations	226	N.S	356
Variety	209	222	167
LxV	**	N.S	**
Increase over	26.00	30.70	10.18
L.Check			

Table 3. Disease reaction of NR-268 in National Trials

Parameter	2005-06	2006-07
Leaf rust (LR)		
(Terminal reaction)	10S (T.Jam)	0
Relative Resistance Index (RRI)	8	9
Yellow Rust (YR)		
(Terminal reaction)	0	5S (AARI)
Relative Resistance Index (RRI)	9	8

Disease Reaction

Disease reaction of NR-268 in data provided by CDRP, Islamabad it gave during two years screening Relative Resistance Index of 8,9 for leaf rust and 9, 8 for yellow rust, respectively, which is desirable (Table 3).

Quality Characteristics

As regards quality characteristics, its grains are bold and gluten contents are good. Protein percentage is also high and has good *chapatti* making quality (Table 4).

Table 4. Quality characteristics of NR-268

Trait	2005-06	2006-07
1000-kernel weight(g)	41.20	41.77
Test weight(kg hl ⁻¹)	75.80	78.35
PSI	40.00	31.00
Ash (%)	1.39	1.33
Dry gluten content(%)	9.12	8.00
Wet gluten (%)	25.61	23.71
Grain protein(%)	12.28	11.46

Table 5. Seeding Date Trial during 2007-08 at NARC, Islamabad

Traits	Sowing dates		
	31.10.07	12.11.07	26.11.07
Wafaq-2001	3598	3492	2651
GA-2002	3310	3565	3028
NR-268	3823	3574	3314
% increase over			
Wafaq-2001	6	2	25
GA-2002	15	0.25	9

Agonomic Trials

In seeding date trial conducted at NARC with three sowing dates and split plot design showed that the NR-268 gave maximum yield on October 31 planting followed by 12 and 26 November (Table 5) with two standard varieties Wafaq-2001 and GA-2002. Seed Rate Trial-2007/08 conducted at NARC by using split plot design showed that it gave maximum yield by using seed @100kg ha⁻¹ (Table 6).

Table 6. Seed Rate Trial during 2007-08 at NARC, Islamabad

Traits	Seed rates (kg ha ⁻¹)		
	80	100	120
Wafaq-2001	3083	3186	3462
GA-2002	3196	3237	3479
NR-268	3462	3479	3666
% increase over			
Wafaq-2001	8	16	6
GA-2002	5	15	5

A high yielding, drought tolerant and disease resistant wheat variety NARC-2009 developed by breeders of Wheat Programme, NARC, with desirable quality traits has been approved by Punjab Seed Council for rainfed areas.

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