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Evaluation of spring bread wheat lines/ varieties in international observation nurseries and yield trials in moderat region of Iran

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Abstract

The main objective of this research was to evaluate spring bread wheat cultivars genotypes selected from joint project of Iran/CIMMIT using several indices. In order to selecting new spring bread wheat cultivars with high yield comparing to widely grown varieties, evaluating resistance to diseases, lodging, shuttering was conductted. Valuablility determination of plant genetic resources received from International centers for utilization in crossing blocks and as active introduction carried out with four set of international nurseies in selected sites via seperated experiments as replicated yield trial or screening nurseries according to test. In first experiment 50 entries was studied by using of an alpha latice model and two replications and 6 desirable genptype selected for further research. In second experiment 30 entries was studied by using of a randomized compelete block design with three replications and 6 superior lines were chosen for more evaluating. In third and fourth sets 287 and 86 entries evaluated as observation nurseries and finally 15 and 11 entries selectd for more studies respectively. For more evaluating, selected genotypes forwarded to preliminary regional wheat yield trial.

Key words: Spring Wheat, International Nurseries Yield Trial.

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1.0 Introduction

In the most countries of the world, self sufficiency in wheat production is a goal and breeders can play an important role to achieve this by releasing or introducing new, high yielding and desirable wheat cultivars[1]. Obviously, it need high rang of breeding materials that can received from breeding program of other countries to extend gene pool of plant population [2,3]. Transfer of genetic materials via seeds is common in the world between farmers and areas from last ago. For example first hard red wheat entered to United State by Monnontes from Russia in 1873 [4]. Nowadays this is not easy and some times is impossible due to quarantine role, but it is possible to receive genetic material of wheat via international nurseries from International Maize and Wheat Improvement Center [5] and International Center for Agricultural Research in the Dry Areas. History of international nurseries is interesting. A stem rust (*Puccinia graminis*) epidemic attacked wheat fields in the USA and Canada in the 1950s. About 60% and 75% of the wheat harvest in the US was destroyed in 1953 and 1954 respectively. Source of damage was a new pathogenic race called 15B, which was resistant to all genes present in existing commercial varieties at that time (anonymous, 2008). Also, a similar race spread widely in Latin America. So in response, the US Department of Agriculture requested that seven nations (Mexico, Colombia, Ecuador, Peru, Chile, Argentina, and Canada) join forces in testing 1000 lines selected from the wheat world collection. It was first International Stem Rust Trial and results exceeded all expectations because new sources of resistance were found for the 15B race, some of which may still be present in commercial wheat varieties today [6].

Another outcome of the trial was the creation of a network through which lines and introductions could be tested and distributed to developing countries.

The first international spring wheat yield nursery was distributed for special studies to 12 countries from Canada to Argentina in 1960. Because of expressed interest of other wheat-producing countries around the world, in 1964 CIMMYT created the International Spring Wheat Yield Nursery (ISWYN) that included lines adapted to high and low latitudes; in 2001, the International Wheat Improvement Network (IWIN that acts like a diplomatic corp. for the CIMMYT Wheat Program) prepared 2,766 sets of 40 different bread wheat, durum wheat, triticale, and barley nurseries. Materials were sent to a global network of 619 wheat scientists from 117 countries around the world. The trials data from are then returned to CIMMYT, catalogued, analyzed and made available to the global wheat improvement community. Totally, result of international nurseies (IWWIP) will published as annual report and countries involved can use resulat of other sites in other countries for more accurate selection of materials. Now, 120 countries will receive materials and ultimate beneficiaries of the fruits of this network are farmers who will receive improved, new high yielding varieties (anonymous, 2008).

Intrernatioal cooperation on germplams not only is useful but essential for human food security in future. So, according to importance of wheat in Iran as basic food and main crop of country which culitvate at more than 50 percent of arable lands, cooperative program with CIMMYT started from previous years and some coomercial bread wheat cultivars (such: Naz, Alborz, Falat, Atrak, Chamran…) originated and selected from international nurseries. Therefor presnt study conducted to evaluation, screening of breeding material of some international nurseies received from

CIMMYT and joint program of CIMMYT-ICARDA for use in crossing blocks as gene sources or entries of advanced yield trials.

2.0 Materials and methods

Field study was done by using of four set of plant genetic resources received from International centers (CIMMYT and ICARDA). Testes achived via seperate experimentes as listed below:

Elite Spring Wheat Yield Trial (ESWYT): This test coducted in Karaj station, Tehran province, with 50 entries (including local check) by using of an alpha latice design and two replications. A 120-90-50 formula of N-P-K fertilizer was used as a base for location. Plot size was 3.6 m² (3 × 1.2 m) and consisted of 6 rows with 20 cm interrow spaces. Plantig was done by experimental planter and irrigation applied as needed.

Elite Bread Wheat Yield Trial (EBWYT): This trial consisited of 30 entries (including local check) and coducted in Zarghan research station, Fars province, by using a randomized compelete block design (RCBD) with three replications. Plot size was 3.6 m² (3 × 1.2 m) and consisted of 6 rows with 20 cm interrow spaces. As pervious test plantig was done by experimental planter and irrigations applied according to need of crop.

International Spring Wheat Screening Nursery (ISWSN): This nursey was conducted in Karaj station, Tehran province and Zarghan research station, Fars province. The test cosisted of 86 entries (including local checkes) and Four improved bread wheat cultivars including Marvdasht, Pishtaz, Shiraz and Bahar were used as ckeckes; each one planted after every 20 entries (plot No. 20, 40, 60, 80). Plot size was 1.2 m² (0.6 × 1.2 m) and consisted of 2 rows with 30 cm interrow spaces. Planting of two sites was done by hand labour and irrigations applied as needed to providing field capacity.

International Bread Wheat Screening Nursery (IBWSN): This nursey was conducted in Karaj and Eslamabad station, Kermanshah provine, and cosisted of 278 entries (including local checkes). Four improved bread wheat cultivars, Marvdasht, Pishtaz, Shiraz and Bahar were used as ckeckes and each one planted after every 20 entries. Plot size was 1.2 m² (0.6 × 1.2 m) and consisted of 2 rows with 30 cm interrow spaces. Planting was done by hand labour at two sites and irrigations applied according to crop need.

Disease scoring: Evaluation of stripe rust, leaf rust and common bunt was done in some parts of country. Modified Cobb's scale [7] and Sari-Prescott [8] were used for rust scoring and other diseases repectively.

Data collecting: Weed control and field records of disease resistance, lodging, heading and maturity dates, plant height, kernel color, and shattering were done in spring.

Statistical analysis: Data analysis for evaluation of entries in ESWYT and EBWYT trials was done by ALPHA and SAS packages repectively, but non parametric ranking method was used for observation nurseries without replication (ISWSN and IBWSN) based on each location assumed as one replication.

3.0 Results and disscusion

ESWYT: Analysis of variance (ANOVA) results of yield data showed siginificance difrences among genotypes (Table-1). The highest yield belonged to entry No. 17 (Table-2). According to field records and result of ANOVA, six entries which showed best field performance were selected for more evaluation in advanced yield trials.

Entry number, pedigree, yield and some physiological traits of selected entries presented in Table-2.

Source of variation	DF	MS
Replication	1	2.9**
Blocks(ADJ)	18	0.53**
Genotype	49	0.67**
Teratment (ADJ)	49	0.53**
Error	31	0.19
CV		4.6

***, **: significant diffrence at 5% and 1% level respectively.**

Table-1. ANOVA of ESWYT yield data

Entry No.	Pedigree	DHE	PLH (cm)	TKW (gr)	YLD (t/ha)
1	LOCAL CHECK:Pishtaz	115	100	40	10.498
16	PASTOR/3/VORONA/ CNO79//KAUZ	117	105	39	10.313
17	CNDO/R143//ENTE/MEXI_2/3/ AEGILOPS SQUARROSA (TAUS)/4/...	113	100	40	10.887
21	MINO	113	105	38	10.345
29	VEE#8//JUP/BJY/3/F3.71/TRM/4 /2*WEAVER/5/HAHN/2*WEAVER/6/WEAVER	116	95	45	10.293
30	CHUM18/7*BCN	113	95	36	10.413
31	KAUZ//ALTAR 84/AOS/3/PASTOR	115	105	36	10.526

Table-2. Mean comparison of some physiological data of selected lines in ESWYT test.

DHE : days to heading, PLH: plant height, TKW:1000 kernel weight

EBWYT: There were significant differences among genotypes at 5% level (Table- 3). The highest yield (8.671 t/ha) produced by entry No. Six superior and high yielding entries with best field records and agronomic traits selected for further considerations. Entry number, pedigree, yield and some agronomic traits of selected entries listed Table-4. Selected lines marked by star in Table-4.

Source of variation	DF	MS
Replication	2	0.314 ns
Genotype	29	0.319*
Error	58	0.191
CV		14

***, ns**: significant diffrence at 5% and 1% level respectively.**

Table-3: ANOVA of EBWYT yield data

Entry No.		Pedigree	YR	DHE	DMA	PLH (cm)	Yield (t/ha)
1		Local Check : Pishtaz	10S	126	170	90	6.840
2		Local Check : Marvdasht	10S	124	169	82	5.146
3		Pfau/Wenver*2//Kiritati	10S	127	169	92	6.535
4		Pfau/Weaver/3/Weaver/Oci/Borl 95	10MR	126	170	90	6.139
5		Up2338*2/Sni/Trap#1/3/Kauz+2//Kauz	5 MS	126	169	87	5.819
6		Wbll1*1/Kkts	R	125	169	91	6.535
7		Wbll 1*2/Chapio	R	126	170	93	6.556
8		Wbll 1*2/Tukuru	10S	127	170	100	5.465
9		Wbll 1*2/4/Yaco/Pbw65/3/Kauz*2/Trap//Kauz	R	127	169	94	5.500
10		Wbll 1*2/Huruku	10MR	125	169	88	5.764
11		Well 1*2/Vivisi	R	126	169	92	5.694
12		Wbll4*/Kukuna//Wbll 1	10S	133	173	80	5.715
13		Fret2/Tukuna//Fret2	O	124	171	66	6.076
14		Wbll1*2/Kuluna	30S	125	171	80	6.674
15	*	Kauz//Altar 84/Aos/3/Milan/Kauz/4/Huites	R	125	171	77	7.125
16	*	Reh/Hare//2*Bcn/3/Croc-1/Ae.Squarrosa (213)//…	R	125	170	86	7.417
17		Cal/Nh//H567.71/3/Seri/4/Cal/Nh/	O	126	171	93	6.347
18	*	Oasis/Skauz//4*Bcn*2/3/Pastor	O	127	170	96	7.681
19		Nac/Th/AC//3*Pvn/3/,Mirlo/Buc/4/2*Pastor	O	128	170	90	6.757
20		Kauz/Pastor//Pbw343	O	124	169	87	6.076
21		Tukuru//Bav92/Rayon	5MR	125	170	85	6.729
22	*	Seri.1B*2/3/Kauz*2/Bow//Kauz	O	126	170	83	6.861
23		Seri.1B//Kauz/Hevo/3/Amad	5S	127	169	92	6.722
24		Attila*2/Star	20S	126	170	84	7.535
25		Attila*2/Pbw 65	10S	127	170	95	7.674
26	*	Pbw65/2*Pastor	R	127	171	90	7.090
27	*	Milan/Kauz//Pastor/3/Pastor	10MS	128	171	100	7.090
28		Rl6043/4*Nac/ /2*Pastor	10S	126	169	102	6.806
29		Milan/Kauz//Prinia/3/Babax	R	129	171	95	5.882
30		Chen/Ae.Sq//2*Opata/3/Wbll1	5S	126	169	87	6.368

Table-4: Some field records and yield of EBWYT entries
YR: yello rust, S: suseptible, MS: mid suseptible, MR: mid resistant, R: resistant, O: not observed, DHE: days to heading, DMT: days to maturity, PLH: Plant height, *: selected.

ISWSN: Ranking was done for yields of two locations and result showed at Table-5. Best grain yield over location (9.354 t/ha) produced by entry 67. Highest yield in Karaj and Zarghan (12.598 and 7.583 t/ha) produced by entries 82 and 10 respctively. Finally, 11 entries were selected for mor evaluation according to field performance of entries, recorded data of agronomic traits during crop season, disease rsistance and result of ranking (Table-5).

TRT	MEAN_M	STD_M	CV_M	MEAN_R	STD_R	CV_R	SUM_R
67	9.354	3.919	41.891	4.250	3.182	74.870	8.5
21	8.875	3.594	40.501	12.250	2.475	20.203	24.5
5	8.667	3.418	39.435	17.000	2.121	12.478	34
7	8.583	2.475	28.834	17.750	20.860	117.519	35.5
81	8.708	3.712	42.629	18.000	7.071	39.284	36
6	8.500	3.771	44.368	21.250	10.253	48.250	42.5
10	8.758	1.662	18.973	24.000	32.527	135.529	48
4	8.313	2.563	30.836	24.250	22.274	91.851	48.5
74	8.229	3.153	38.309	27.000	3.536	13.095	54
44	8.146	3.624	44.488	29.750	7.425	24.957	59.5
11	8.125	2.652	32.636	31.250	18.031	57.700	62.5

Table-5: Result of yield ranking over locations for ISWSN test.
TRT: Entry number, MEAN_M: Mean yield of genotype, STD_M: Standard deviation of yield; CV_M: Coefficient variation of yield, MEAN_R: Mean of Rank, STD_R: Standard deviation of rank, CV_R:Coefficient variation of rank, SUM_R: Sum of ranks.

IBWSN: Yield ranking was done for yields of locations and result showed at Table-6. Highes grain yield over two lcations (12.700 t/ha) produced by entry 80. Highest yield in Karaj and Kermanshah (13.250 and 14.264 t/ha) produced by entries 80 and 256 respctively. Finally, 15 entries were selected for mor evaluation according to field performance of entries, recorded data of agronomic traits during crop season, disease rsistance and result of ranking (Table-6).

TRT	MEAN_M	STD_M	CV_M	MEAN_R	STD_R	CV_R	SUM_R
263	12.079	0.583	4.824	8.750	1.768	20.203	17.5
203	12.019	1.676	13.949	13.750	13.789	100.281	27.5
266	11.846	1.550	13.087	15.750	15.203	96.526	31.5
104	11.444	0.864	7.549	21.750	2.475	11.379	43.5
24	11.393	1.146	10.054	23.500	14.849	63.188	47
224	11.617	1.874	16.133	28.500	31.820	111.648	57
111	11.286	0.287	2.543	28.750	18.031	62.717	57.5
270	11.188	0.855	7.645	31.000	4.243	13.686	62
247	11.287	0.065	0.575	33.500	31.820	94.984	67
239	11.116	0.576	5.184	34.250	8.132	23.742	68.5
268	11.250	1.532	13.618	35.000	33.941	96.975	70
28	11.091	0.541	4.876	35.750	10.253	28.680	71.5
76	11.087	0.358	3.232	37.250	19.445	52.203	74.5
45	11.136	1.370	12.306	38.500	28.991	75.302	77
117	11.117	1.226	11.025	38.500	21.920	56.936	77

Table-6: Result of yield ranking over locations for IBWSN test.
TRT: Entry number, MEAN_M: Mean yield of genotype, STD_M: Standard deviation of yield; CV_M: Coefficient variation of yield, MEAN_R: Mean of Rank, STD_R: Standard deviation of rank, CV_R:Coefficient variation of rank, SUM_R: Sum of ranks.

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