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# VARIETAL DIFFERENCES OF SOME ECONOMIC IMPORTANCE IN 36 EXOTIC DURUM TYPES UNDER TWO DENSITY CONDITIONS

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Thirty-six exotic durum types were tested under two density conditions in 1970-71. On the basis of their superior performance 12 types were selected and sown under the same density conditions in the following year.

On an average of both the densities, 4 types namely 02, 04, 013, 014 were very high yielding in 1970-71, whereas 17 and 6 types each could be classed in the medium yielding category under high and low density conditions. Type 035 under high and 019 under low density conditions were low yielders during both the years.

## INTRODUCTION

Durum wheat is by far the most important 28-chromosome species and ranks second in importance to bread wheat species. It is better adapted to semi-arid regions of the world and has greater yield potential than the common wheats.

Durum as a class contain higher percentage of proteins than other wheats. In general, the range is 10–15% (14% moisture) and on an average a level of 13.5 to 14% is considered the best. About 10% of the world wheat crop comprises of durum species. It is mostly grown in U.S.A., U.S.S.R., China, Canada, Australia, Argentina, Mexico, Italy, Spain, Algeria, Iraq, Syria, Turkey, Morocco, Tunisia etc. In Pakistan durums were grown in certain areas in the beginning of the present century. The emphasis of research work was entirely laid on bread wheats and soon high yielding varieties were developed replacing the durum types with the result that the species has become almost extinct from cultivation.

For diversification of wheat cultures and especially in view of projected self sufficiency in common wheat production, introduction of *Triticum durum* is likely to be more profitable in earning foreign exchange and good will, in the neighbouring Middle-East countries.

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Howard and Howard (1909) surveyed the wheat germ-plasm in area now forming part of Pakistan and reported three types of durum ($T_1$, $T_2$ and $T_3$) out of 25 classified types. Since then no other work has been reported anywhere in the country. Recent work on classification of durum types has been reported by Rudenko (1960), Mustafaev and Janova (1963), Mustafaev *et al.* (1964), Popov and Dimova (1966), Scarascia *et al.* (1966), Suput (1966), Cygankov (1967), Dionigi (1967), Bares and Vlach (1968), Borrelli (1969), Martynjuk (1969), Pavlov (1969), and Kaltsikes and Larter (1970) from experiments conducted in different countries and under different environmental conditions.

## MATERIALS AND METHODS

The work on durum species was initiated in 1970-71 when 36 exotic durum types (Table 1) from Mexico alongwith 4 standards (Mexipak, Dwarf Durum, Chenab 70 and Durum 2031) were tried under high (drill sowing) and low

Table 1. *Pedigree of new durum types studied during the Experimentation.*

| Type | Pedigree | Type | Pedigree |
|---|---|---|---|
| 01 | 22234-47M-5Y-1M-0Y | 019 | II-23055-33M-1R-3M-0Y |
| 02 | 21570-9M-6R-1M-100M | 020 | II-22232-3M-1Y-1M-0Y |
| 03 | 22232-9M-2Y-100Y-0M | 021 | II-22550-3M-3Y-3M-0Y |
| 04 | 22234-52M-3Y-1M-100Y-0M | 022 | 23055-56M-5Y-1M-0Y |
| 05 | 22234-18M-8R-0M | 023 | 23055-56M-5Y-2M-0Y |
| 06 | 25609-6M-100Y-100M | 024 | 21566-44Y-6Y-1Y-1M-0Y |
| 07 | 25609-10M-100Y-0M | 025 | 22234-9M-2Y |
| 08* | Volunteer | 026 | 2221-18M-8R |
| 09 | II-28968-1Y | 027 | 21276-3Y-1Y-1Y |
| 010 | II-28969-1Y | 028 | 23626-5M-3R |
| 011 | II-28971-1Y | 029 | 21276-3Y-1Y-1Y |
| 012 | II-28984-1Y | 030 | D-21279-6M-2R-11M |
| 013 | II-27589-1M-1Y | 031* | Cob Durum |
| 014 | II-27589-5M-1Y | 032* | Chapla 67 (Teslija) |
| 015 | II-27595-8M-1Y | 033 | D-22550-3M-3Y-3M-0Y |
| 016 | II-27601-6M-1Y | 034 | D-21276-3Y-6Y-1Y |
| 017 | D-25609-6M-0Y | 035 | 27649-10M-1Y |
| 018 | II-24102-9Y-3M-0Y | 036* | V-2-447 |

*Cross

(12-inch spacing) density conditions (Experiment No. 1); and in the following year, 12 selected types were again tested under the same density conditions (Experiment No. 2). The experiments were conducted in randomized block with single rows of 11 feet length with three replications. The data on height of plant, number of days to spike emergence, number of spikes per plant, number of spikelets per spike, number of kernels per spike, kernel weight and yield per plot (gms) were recorded and analysed by the method of analysis of variance for statistical significance.

## RESULTS AND DISCUSSION

The differentiation of available germ-plasm into unit types, beside giving complete idea of the extent of variability in a particular crop, also admits easy spotting out of desirable genes and facilitates the work of a plant breeder to improve and maintain the germ-plasm. As the phenotypic manifestation of a character depends upon the environment in which it is grown, therefore, the existing breeding material of wheat belonging to *Triticum durum* was grown under two density conditions to differentiate and categorize the available types.

Table 2 shows the statistical analysis of different plant characters; whereas Table 3 represents the range, means and standard deviations of the durum types studied under high and low density conditions for the years 1970-71 and 1971-72. Similarly Table 4 (a and b) shows the range, means and standard deviations of the three groups which were categorized on the basis of their performance during the experimentation.

For plant height the existing durum wheats have been classified into three categories; tall, semi-dwarf and dwarf. Type 04 was tall statured under both the densities in both the years whereas 5 types namely, 02, 013, 014, 022 and 025 were semi-dwarf. Similarly three classes for days to spike emergence were differentiated. Under all the densities, 04 was early for spike emergence and five types namely, 02, 07, 013, 014, 022 were medium in spike emergence.

Of the environmental factors, density plays a prominent role in the expression of number of spikes. On this basis the standard variety, Durum 2031 was the highest spike bearing variety whereas, types 04, 014, 022, 025 were in the medium category during both the years under all densities. Similarly Fajersson (1957), Nelson (1960), Popov and Dimova (1966), Suput (1966), Bures and Vlach (1968) distinguished different durum types with reduced tillering capacity under high density conditions. Only 4 types namely 07, 013, 014, and 022 were categorized for medium number of spikelets per spike under the two densities studied.

Table 2. *Statistical significance of durum types studied under two density conditions during the years* 1970-71 *and* 1971-72.

| | Plant height (cms) | Days to spike emergence | Spikes per plant | Spikelets per spike | Kernels per spike | 100-Kernel weight (gms) | Plot yield (gms) |
|---|---|---|---|---|---|---|---|
| Types | | | | | | | |
| 1970-71 | ** | ** | ** | ** | ** | ** | ** |
| 1971-72 | ** | ** | ns | ** | ** | ** | ** |
| Density | | | | | | | |
| 1970-71 | ** | ** | ** | ** | ** | ** | ** |
| 1971-72 | ** | ** | ** | ** | ** | ** | ** |
| Types × Density | | | | | | | |
| 1970-71 | ** | ** | ** | * | ns | ns | ** |
| 1971-72 | ns | ** | ns | ** | ns | ** | ns |

*Significant at .05 level of probability.

**Significant at .01 level of probability.

Table 3. *Means, range and standard deviations of 7 morphological characters of durum types studied under high and low density conditions during the years 1970-71 and 1971-72.*

| Plant characters | High density | | | Low density | | |
|---|---|---|---|---|---|---|
| | Mean | Range | S.D. | Mean | Range | S.D. |
| Plant height (cms) | | | | | | |
| 1970-71 | 86.8 | 72.0–107.5 | 8.33 | 84.1 | 70.4–99.4 | 7.54 |
| 1971-72 | 94.5 | 83.9–115.2 | 9.72 | 86.1 | 74.6–102.7 | 8.19 |
| Days to spike emergence | | | | | | |
| 1970-71 | 103.3 | 97.0–107.7 | 2.60 | 105.6 | 100.0–108.7 | 2.65 |
| 1971-72 | 107.0 | 95.0–114.3 | 5.01 | 108.3 | 95.8–115.0 | 5.24 |
| Spikes per plant | | | | | | |
| 1970-71 | 9.2 | 7.5–11.4 | 0.81 | 14.5 | 11.7–19.1 | 1.84 |
| 1971-72 | 10.7 | 9.9–12.0 | 0.69 | 13.0 | 11.2–14.6 | 1.06 |
| Spikelets per spike | | | | | | |
| 1970-71 | 19.8 | 18.0–22.5 | 1.01 | 20.4 | 17.6–22.8 | 1.32 |
| 1971-72 | 19.6 | 18.4–22.3 | 1.16 | 20.8 | 19.4–22.6 | 1.03 |
| Kernels per spike | | | | | | |
| 1970-71 | 54.6 | 30.4–70.2 | 7.84 | 59.8 | 38.2–84.4 | 8.55 |
| 1971-72 | 51.5 | 43.8–61.6 | 6.67 | 69.2 | 55.5–75.9 | 5.62 |
| 100-kernel weight (gms) | | | | | | |
| 1970-71 | 4.56 | 3.22–6.42 | 0.73 | 4.90 | 3.11–6.10 | 0.71 |
| 1971-72 | 6.05 | 4.75–7.10 | 0.72 | 5.59 | 4.60–6.58 | 0.62 |
| Plot yield (gms) | | | | | | |
| 1970-71 | 387.2 | 219.2–646.2 | 91.66 | 265.3 | 161.8–390.7 | 60.25 |
| 1971-72 | 547.1 | 417.9–787.7 | 98.33 | 345.1 | 251.7–411.0 | 44.98 |

Table 4(a). *Means, range and total number of durum types differentiated in three groups under high and low density conditions in* 1970-71.

| Plant characters | Group | High density | | Low density | |
|---|---|---|---|---|---|
| | | Mean* | Range | Mean* | Range |
| Plant height (cms) | Tall | 101.6 (6) | 95.1–107.5 | 96.6 (8) | 92.4–99.4 |
| | Semi-dwarf | 85.5 (30) | 78.6–94.6 | 82.4 (27) | 77.5–89.4 |
| | Dwarf | 74.4 (4) | 72.0–77.1 | 73.4 (5) | 70.4–75.8 |
| Days to spike emergence | Early | 99.1 (10) | 97.0–100.0 | 101.0 (6) | 100.0–102.7 |
| | Medium | 103.6 (21) | 100.7–106.3 | 105.9 (28) | 103.0–108.0 |
| | Late | 107.5 (9) | 107.3–107.7 | 108.6 (6) | 108.3–108.7 |
| Spikes per plant | High | 10.7 (5) | 10.1–11.4 | 17.9 (5) | 16.6–19.1 |
| | Medium | 9.2 (29) | 8.4–10.0 | 14.6 (27) | 12.8–16.1 |
| | Low | 8.1 (6) | 7.5–8.3 | 12.3 (8) | 11.7–12.6 |
| Spikelets per spike | High | 21.6 (6) | 20.9–22.5 | 22.2 (8) | 21.9–22.8 |
| | Medium | 19.7 (29) | 18.8–20.8 | 20.4 (25) | 19.3–21.6 |
| | Low | 18.4 (5) | 18.0–18.7 | 18.4 (7) | 17.6–18.9 |
| Kernels per spike | High | 66.4 (6) | 63.3–70.2 | 74.1 (5) | 69.5–84.4 |
| | Medium | 54.3 (30) | 47.9–62.4 | 59.9 (30) | 51.3–67.8 |
| | Low | 39.2 (4) | 30.4–43.8 | 45.2 (5) | 38.2–50.1 |
| 100-kernel weight (gms) | High | 5.88 (6) | 5.43–6.42 | 5.81 (7) | 5.60–6.10 |
| | Medium | 4.45 (30) | 3.93–5.18 | 4.73 (28) | 4.13–5.46 |
| | Low | 3.42 (4) | 3.22–3.57 | 3.62 (5) | 3.11–4.06 |
| Plot yield (gms) | High | 532.9 (7) | 480.3–646.2 | 352.8 (10) | 337.5–390.7 |
| | Medium | 379.1 (26) | 304.8–471.3 | 247.5 (25) | 205.5–318.2 |
| | Low | 271.5 (7) | 219.2–295.3 | 178.8 (5) | 161.8–199.3 |

*In parenthesis are given the total number of durum types differentiated.

Table 4(b). *Means, range and total number of durum types differentiated in three groups under high and low density conditions in* 1971-72.

| Plant characters | Group | High density | | Low density | |
|---|---|---|---|---|---|
| | | Mean* | Range | Mean* | Range |
| Plant height (cms) | Tall | 112.2 (2) | 109.2–115.2 | 100.1 (2) | 97.6–102.7 |
| | Semi-dwarf | 91.8 (9) | 85.9–99.4 | 85.0 (8) | 79.5–89.8 |
| | Dwarf | 83.9 (1) | | 76.2 (2) | 74.6–77.8 |
| Days to spike emergence | Early | 95.0 (1) | | 95.8 (1) | |
| | Medium | 106.3 (8) | 104.8–109.8 | 108.3 (9) | 104.0–113.3 |
| | Late | 113.0 (3) | 112.3–114.3 | 114.3 (2) | 113.5–115.0 |
| Spikes per plant | High | 12.0 (2) | 11.9–12.0 | 14.3 (3) | 14.1–14.6 |
| | Medium | 10.5 (9) | 10.1–11.3 | 12.9 (7) | 12.4–13.6 |
| | Low | 9.9 (1) | | 11.4 (2) | 11.2–11.5 |
| Spikelets per spike | High | 22.3 (1) | | 22.3 (3) | 21.9–22.6 |
| | Medium | 19.4 (10) | 18.5–21.2 | 20.5 (7) | 20.2–21.2 |
| | Low | 18.4 (1) | | 19.4 (2) | 19.4–19.5 |
| Kernels per spike | High | 60.7 (3) | 59.6–61.6 | 75.9 (1) | — |
| | Medium | 49.8 (7) | 44.9–56.4 | 69.9 (10) | 63.7–74.7 |
| | Low | 43.9 (2) | 43.8–43.9 | 55.5 (1) | — |
| 100-kernel weight (gms) | High | 7.07 (2) | 7.03–7.10 | 6.46 (2) | 6.34–6.58 |
| | Medium | 6.17 (7) | 5.87–6.72 | 5.59 (8) | 5.20–6.18 |
| | Low | 5.09 (3) | 4.75–5.27 | 4.71 (2) | 4.60–4.82 |
| Plot yield (gms) | High | 787.7 (1) | | 411.0 (1) | |
| | Medium | 548.7 (9) | 476.3–610.8 | 360.7 (8) | 324.0–381.2 |
| | Low | 419.7 (2) | 417.9–421.5 | 281.3 (3) | 251.7–299.3 |

*In parenthesis are given the total number of durum types differentiated.

The number of kernels is one of the most important component of yield. Accordingly, three classes of high, medium and low number of kernels per spike were differentiated. Four types namely 02, 04, 025, Durum 2031 had medium number of kernels per spike in both the years under all the densities. The standard vulgare types gave greater number of kernels per spike as reported by Dionigi (1967).

100-kernel weight was differentiated into three categories viz; high, medium and low kernel weight. Only one type (013) and four types namely 04, 020, 022 and 025 gave the high and medium kernel weights respectively during both the years under both the densities. Type 019 had low kernel weight in all the conditions studied. Kernel weight was found to be higher under low density as against high density condition, confirming the results of Suput (1966) and Bares and Vlach (1968).

Plot yield is the total expression of most of the morphological and physiological characters of a plant and is the net result of the interaction of genotype with environmental factors. On this basis six types namely 02, 04, 013, 014, 020, 022 and nine (02, 04, 05, 07, 08, 012, 013, 014, 025) high yielding types were differentiated under high and low densities in 1970-71, Chenab 70 being common in these; whereas only one type (02) could fall in this category in 1971-72 under low density. 25 types each were differentiated under medium yielding group under high and low densities in 1970-71, whereas only 9 and 7 types fell in this class in 1971-72. Under low yield category 7 and 4 types in 1970-71 and 2 and 3 types in 1971-72 were grouped under both the densities.

On an average of both the densities, 4 types namely 02, 04, 013, 014 were very high yielding in 1970-71, whereas 17 and 6 types each could be classed in the medium yielding category under high and low density conditions. Type 035 and 019 were low yielders under respective densities in respective years. Similar classification of 1200 specimens was reported by Rudenko (1960). The reaults of Popov and Dimova (1966), Suput (1966) and Bares and Vlach (1968) showed that higher density was responsible for increased yield in all the varieties they studied.

An overall review reveals that under high and low density conditions type numbers 02, 04, 013, 014 showed better performance for both the years. In future breeding programme, these promising cultures must be utilized for the speedy improvement of durum wheats in Pakistan.

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