

HY355 WHITE SPRING WHEAT

HY355, white spring wheat (*Triticum aestivum* L.) combines high grain yield, normal height and photoperiod insensitivity. HY355 is heterogeneous for kernel hardness with 55% of the breeder lines rated hard and 45% rated soft. HY355 is the first registered wheat cultivar eligible for grades of Canada Prairie Spring (white). It received a 2-yr interim registration on 6 May 1988.

Key words: Wheat (spring), cultivar description

[Blé de printemps blanc HY355.]

Titre abrégé: Blé de printemps blanc HY355.

HY355, cultivar de blé de printemps blanc (*Triticum aestivum* L.) a un rendement grainier élevé, une hauteur normale et est insensible à la photopériode. Il est hétérogène pour la vitrosité du grain, 55% des lignées d'obtention étant classées vitreuses et 45%, tendres. HY355 est le premier cultivar de blé homologué admissible aux catégories de blé de printemps des Prairies canadiennes (blanc). Il a reçu une homologation provisoire de deux ans le 6 mai 1988.

Mots clés: Blé (de printemps), description de cultivar

HY355 white spring wheat (*Triticum aestivum* L.) was developed at the Agriculture Canada Research Station, Swift Current by the South Saskatchewan Wheat Program. A 2-yr interim registration, No. I 72, was issued for HY355 on 6 May 1988 by the Food Production and Inspection Branch of Agriculture Canada.

Pedigree and Breeding Method

HY355 was selected from a cross made in 1977 between HY320 and NB402. A modified pedigree method and early generation testing procedures were used to evaluate the segregants. The F₁, F₃, F₅, and F₇ generations were grown in a winter nursery in Brawley, California. In each of the F₄, F₆, and F₈ generations, selections were evaluated in replicated tests at two locations for grain yield potential, agronomic characteristics, resistance to leaf and stem rust, and the end-use suitability factors of kernel hardness, protein concentration and gluten strength. Because genotypes homozygous and homogeneous for a medium level of kernel hardness occur infrequently, the heterozygote

for kernel hardness, which has an intermediate level of hardness, was selected in the F₄, F₆ and F₈ generations. Size of families required to retain the heterozygote was estimated using information that kernel hardness is controlled by relatively few genes (Symes 1965; Baker 1977). Kernel hardness was measured by the time required to grind 5-g samples of wheat kernels on the Brabender SM1 mill (Kosmolak 1978). Progeny with grinding time values intermediate to Neepawa and HY320 were selected in the F₄, F₆, and F₈ (Table 1). 7722-AN is the F₄ progenitor of the F₆ lines, and 7722-AN4 is the F₆ progenitor of the F₈ lines. Near-infrared reflectance spectroscopy was used to measure kernel hardness of the 133 breeder lines of HY355 (Williams and Sobering 1986).

In 1981, an F₈ line designated 7722-AN4B became the progenitor of HY355. In 1982, it was evaluated in the High Yield Wheat 'B' level test for agronomic performance, reaction to diseases, and grain quality; from 1983 to 1985 and in 1987 it was assessed in the High Yield Wheat Co-operative tests as HY355. Breeder seed consists of 133 breeder

Table 1. Grinding time values for Neepawa, HY320 and the progenitors of HY355

| | Generation | Grinding time (minutes) | | |
|------------|----------------|-------------------------|------|------|
| | | 1979 | 1980 | 1981 |
| Neepawa | | 0.56 | 0.62 | 0.53 |
| HY320 | | 1.17 | 1.11 | 1.19 |
| 7722-AN | F ₄ | 0.93 | | |
| AN2 | F ₆ | | 0.56 | |
| AN3 | F ₆ | | 0.88 | |
| AN4 | F ₆ | | 0.76 | |
| AN5 | F ₆ | | 0.62 | |
| AN4A | F ₈ | | | 0.59 |
| AN4B=HY355 | F ₈ | | | 0.79 |
| AN4C | F ₈ | | | 0.86 |
| AN4D | F ₈ | | | 0.55 |
| AN4E | F ₈ | | | 0.73 |

lines which derive from single F₁₀ plant selections. The 133 breeder lines were selected from 144 plant-rows grown initially in 1984.

Performance and Adaptation

The frequency distribution for particle size index of the breeder lines exhibited a bimodal distribution with 55% of the lines having values between 56.4 and 66.9 (hard) and 45% of the lines having values between 68.8 and 74.6 (soft) (Table 2). This confirms that the F₈ line 7722-AN4B, the progenitor of HY355, was heterozygous for kernel hardness. The particle size index of HY355 (65.7) was similar to the mean of the lines (65.2) and also to HY320 (65.6), which is also made up of breeder lines heterogeneous for kernel hardness (De Pauw et al. 1987).

The main attribute of HY355 has been high grain yield in all areas of Western Canada (Tables 3 and 5). HY355 yielded 23% more ($P < 0.05$) than Neepawa Canada Western Red Spring wheat in the High Yield Wheat Co-operative tests. HY355 significantly outyielded the other check cultivars in comparative trials in Zone 2, which consists primarily of Brown and Dark Brown soils. Under dryland conditions, in Zone 2, HY355 outyielded Neepawa by 31%, Glenlea by 24% and HY320 by 10%. HY355 has yielded inconsistently relative to the checks in

Zones 1 and 3. Under irrigated conditions HY355 outyielded Neepawa by 36%, Glenlea by 34% and HY320 by 4%.

On average, HY355 matures slightly earlier than HY320, but 3–4 d later than Neepawa (Tables 4 and 5). HY355 is similar in straw height to Neepawa and 15–17 cm taller than the semidwarf HY320 (Tables 4 and 5). HY355 lodges more than the checks. Test weight of HY355 is slightly greater than the checks and the seed size is intermediate to that of Neepawa and Glenlea.

HY355 is the first cultivar registered that is eligible for grades of Canada Prairie Spring (white). The end-use suitability factors of kernel hardness, protein content, and gluten strength are intended to be at a medium level (Hetland 1978).

Injection of loose smut inoculum into the florets of HY355 results in a susceptible reaction (Table 6), whereas under conditions of natural infection a lower incidence of loose smut occurs (Table 7) compared to HY320. Dr. J. J. Nielsen (pers. commun.) classifies HY355 as physiologically susceptible, but morphologically moderately resistant to loose smut.

Description

SPIKE. Oblong to fusiform, lax to middense, long, seminodding, awned; glume midwide, long, glabrous, white; glume shoulder some

Table 2. Frequency distribution for particle size index (PSI) of the 133 breeder lines of HY355 and check cultivars

| Breeder lines | | Check cultivars | | |
|------------------------|-----------|-----------------|-----------|------|
| Class interval for PSI | Frequency | Cultivar | Class | PSI |
| 55-56 | 4 | Neepawa | CWRS | 53.7 |
| 57-58 | 30 | HY320 | CPS-red | 65.6 |
| 59-60 | 24 | HY355 | CPS-white | 65.7 |
| 61-62 | 8 | | | |
| 63-64 | 4 | | | |
| 65-66 | 3 | | | |
| 67-68 | 1 | | | |
| 69-70 | 15 | | | |
| 71-72 | 30 | | | |
| 73-74 | 14 | | | |

Table 3. Means and least significant differences for grain yield (kg ha^{-1}) of HY355 and check cultivars, High Yield Wheat Co-operative tests, 1983-1985, 1987

| Yr | Cultivar | Zone 1† | Zone 2 | Zone 3 | Mean | LSD | No of stations |
|-----------------------|----------|---------|--------|--------|------|-----|----------------|
| 1983 | Neepawa | 2904 | 3132 | 3195 | 3053 | 280 | 13 |
| | Glenlea | 3494 | 3615 | 4140 | 3649 | | |
| | HY320 | 3606 | 3902 | 3555 | 3735 | | |
| | HY355 | 3726 | 4410 | 4605 | 4177 | | |
| 1984 | Neepawa | 3570 | 2157 | 3615 | 2753 | 300 | 12 |
| | Glenlea | 4137 | 2123 | 4300 | 2989 | | |
| | HY320 | 4060 | 2464 | 4785 | 3250 | | |
| | HY355 | 3420 | 2629 | 4810 | 3190 | | |
| 1985 | Neepawa | 4000 | 2275 | 4355 | 3310 | 320 | 14 |
| | Glenlea | 4585 | 2332 | 5015 | 3681 | | |
| | HY320 | 5167 | 2863 | 6200 | 4327 | | |
| | HY355 | 4710 | 2952 | 5320 | 4044 | | |
| 1987 | Neepawa | 3086 | 2991 | 3550 | 3068 | 180 | 16 |
| | Glenlea | 3250 | 3158 | 3990 | 3250 | | |
| | HY320 | 3294 | 3439 | 4020 | 3412 | | |
| | HY355 | 3400 | 3904 | 3130 | 3635 | | |
| Mean | Neepawa | 3372 | 2647 | 3697 | 3057 | | |
| | Glenlea | 3816 | 2807 | 4414 | 3397 | | |
| | HY320 | 4013 | 3161 | 4729 | 3686 | | |
| | HY355 | 3855 | 3474 | 4657 | 3770 | | |
| LSD ($P \leq 0.05$) | | 260 | 210 | 330 | 170 | | |
| No. of station yr | | 21 | 27 | 7 | 55 | | |

†Zone 1 = locations in Manitoba and southeastern Saskatchewan; Zone 2 = locations in southern Alberta and western Saskatchewan; and Zone 3 = locations in Peace River and Parkland.

square, some elevated, midwide; glume beak midwide, tending to acuminate.

KERNEL. Color white; size midsize to large;

shape long, midwide to wide, elliptical; cheek angular to slightly rounded; brush small size with midlength hairs; crease midwide to wide, middeep; germ midsize, elliptical.

Table 4. Means and least significant differences for agronomic traits of HY355 and check cultivars in High Yield Wheat Co-operative tests, 1983-85, 1987

| Cultivar | Maturity (d) | Height (cm) | Lodging (1-9)† | Test wt (kg hL ⁻¹) | 1000-kernel wt (g) |
|-----------------------|--------------|-------------|----------------|--------------------------------|--------------------|
| Neepawa | 97.7 | 84 | 2.4 | 79.0 | 30.2 |
| Glenlea | 101.0 | 90 | 3.0 | 79.2 | 39.9 |
| HY320 | 102.4 | 70 | 3.4 | 79.4 | 37.5 |
| HY355 | 101.8 | 87 | 4.2 | 79.5 | 35.4 |
| LSD ($P \leq 0.05$) | 0.5 | 1.5 | 1.0 | 0.4 | 0.6 |
| No. of station yr | 42 | 54 | 21 | 46 | 46 |

†1 = no lodging, 9 = completely lodged.

Table 5. Means and least significant differences for agronomic traits of HY355 and check cultivars in High Yield Wheat Irrigated Co-operative tests, 1983-85, 1987

| Cultivar | Yield (kg ha ⁻¹) | Maturity (d) | Height (cm) | Lodging (1-9)† |
|-----------------------|------------------------------|--------------|-------------|----------------|
| Neepawa | 3964 | 102.5 | 91 | 1.4 |
| Glenlea | 4030 | 106.0 | 98 | 1.6 |
| HY320 | 5181 | 106.8 | 77 | 2.4 |
| HY355 | 5414 | 105.5 | 92 | 3.3 |
| LSD ($P \leq 0.05$) | 550 | 1.2 | 4 | 2.2 |
| No. of station yr | 13 | 11 | 10 | 6 |

†1 = no lodging, 9 = completely lodged.

Table 6. Disease reactions of HY355 and check cultivars, High Yielding Wheat Co-operative tests, 1983-1985, 1987

| Cultivar | Year | Leaf rust | Stem rust | Loose smut | Bunt | Common root rot |
|----------|------|-----------|-----------|------------|--------|-----------------|
| Neepawa | 1983 | 50M† | 10R | — | 8.3 I | 15‡ |
| | 1984 | 60M | 10R | — | 26.5 I | 29 |
| | 1985 | 40M | 10R | 24 MR | 29.2 S | 33 |
| | 1987 | 40MRMS | 5R | 8 R | 12.7 S | 25 |
| Gleanlea | 1983 | TR | 5VR | — | 6.7 I | 10 |
| | 1984 | OTR | 5VR | — | 41.2 S | 20** |
| | 1985 | TR | 10R | 0 R | 20.8 I | 27 |
| | 1987 | 3VR | 5R | 0 R | 13.0 S | 16** |
| HY320 | 1983 | 10R | 10VR | 96 HS | 16.7 I | 19 |
| | 1984 | OTR | 30R | — | 75.2 S | 35 |
| | 1985 | 1R, 20MR | 10VR | 93 HS | 52.8 S | 39 |
| | 1987 | 10R | 20R | 97 HS | 42.0 S | 29 |
| HY355 | 1983 | 30MR | 20VR | 82 HS | 7.7 I | 14 |
| | 1984 | 30MR | 40R | 86 HS | 77.7 S | 43** |
| | 1985 | 30MR | 20R | 100 HS | 58.7 S | 38 |
| | 1987 | 30M | 20R | 88 HS | 45.2 S | 26 |

†Percent infection and type of reaction: TR = trace resistant; VR = very resistant; R = resistant; MR = moderately resistant; I = intermediate resistance; M = intermediate to MR and MS; MS = moderately susceptible; S = susceptible; HS = highly susceptible; and — = no data available.

‡Disease index.

**Values differ from those for Neepawa at the 1% probability level.

Table 7. Percent infection and reaction type to loose smut based on artificial inoculation and natural infection types

| Cultivar | Artificial inoculation reaction type | Natural infection (%) | | | | | Reaction type |
|----------|--------------------------------------|-----------------------|-----------|-----------|-----------|-----------|---------------|
| | | 1983/1984 | 1984/1985 | 1985/1986 | 1986/1987 | 1987/1988 | |
| Benito | MR† | 0.5 | 0.8 | 0.6 | 2.8 | 0.1 | R |
| Columbus | MS-S | 0.3 | 0.6 | 1.2 | 3.1 | 0 | MR |
| Sinton | MS-S | 1.9 | 2.5 | 1.6 | 3.3 | 1.3 | MS |
| Laura | HS | 0.3 | 0.6 | 1.1 | 1.6 | 0.3 | MR |
| HY320 | HS | | 6.3 | 3.4 | 6.4 | 1.0 | S |
| HY355 | HS | 0.3 | 1.3 | 1.8 | 3.6 | 0.5 | MR |

†Type of reaction is the same as for Table 6.

MATURITY. About 4 d later than Neepawa and 0.6 d earlier than HY320.

STRAW. Similar in length to Neepawa, 17 cm taller than HY320; not as strong as Neepawa; hollow.

SHATTERING. Resistant, similar to Neepawa.

DROUGHT RESPONSE. Good, comparable to Neepawa.

DISEASE REACTION. Resistant to prevalent races of stem rust caused by *Puccinia graminis* Pers. f. sp. *tritici* Eriks. and E. Henn.; moderately susceptible to prevalent races of leaf rust caused by *P. recondita* Rob. ex Desm. f. sp. *tritici*; moderately resistant to common root rot caused primarily by *Bipolaris sorokiniana* (Sacc. in Sorok.) Shoem.; moderately resistant to loose smut caused by *Ustilago tritici* (Pers.) Rostr.; and susceptible to common bunt caused by *Tilletia foetida* (Wallr.) Liro and *T. caries* Tul. (Tables 6 and 7).

SAWFLY REACTION. Susceptible.

PHOTOPERIOD RESPONSE. Insensitive.

END-USE SUITABILITY. Eligible for grades of Canada Prairie Spring (white).

Maintenance and Distribution of Pedigreed Seed

Breeder seed originating from 133 breeder

lines will be maintained by the Seed Section of the Agriculture Canada Experimental Farm, Indian Head, Saskatchewan, Canada S0G 2K0. Distribution and multiplication of pedigreed seed will be handled by SECAN Association, 512-885 Meadowlands Drive, Ottawa, Ontario, Canada K2C 3N2.

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