

Registration of GA 120R1B3 Germplasm Line of Cotton

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ABSTRACT

GA 120R1B3 (Reg. No. GP-931, PI 660980) is a noncommercial breeding line of cotton (*Gossypium hirsutum* L.) jointly released by the USDA-ARS and the Agricultural Experiment Station at the University of Georgia in 2010. GA 120R1B3 was created using a single-seed descent method in a backcrossing program to combine the resistance to *Meloidogyne incognita* (southern root-knot nematode) from M-120 RNR with the high-yielding, high fiber-quality characteristics of PD 94042. Two greenhouse evaluations of nematode reproduction were conducted in 2007. Field evaluations for yield and fiber quality were conducted from 2007 to 2009 and included three tests in fields infested with *M. incognita* and four tests in fields without *M. incognita*. GA 120R1B3 has a high level of resistance to *M. incognita* that is equivalent to that found in M-120 RNR, but GA 120R1B3 has significantly better lint percentage and fiber quality than M-120 RNR. GA 120R1B3 has a yield and fiber quality generally comparable to commercial cultivars and a lint percentage that was often greater than that of the commercial standards. GA 120R1B3 had good yield and excellent fiber quality in both the presence and absence of *M. incognita*.

M*eloidogyne incognita*, the southern root-knot nematode, causes greater yield losses in cotton (*Gossypium hirsutum* L.) than any other single pathogen in the United States, with losses estimated at more than \$100 million each year (Cotton Disease Loss Estimate Committee, 2008). All areas of the U.S. cotton belt can suffer yield loss from *M. incognita* (Cotton Disease Loss Estimate Committee, 2008). The first generation of highly resistant cotton germplasm, Auburn 623 RNR (Reg. No. GP-20, PI 529546), was developed in the 1960s, released in 1970, and registered in 1974 (Shepherd, 1974). Auburn 623 RNR was used to create Auburn 634 RNR (Reg. No. GP-166, NSL 161720; Shepherd, 1982), which was used to create M-120 RNR (Reg. No. GP-620, PI 592509). M-120 RNR was released in 1989 and registered in 1996 (Shepherd et al., 1996). Although M-120 RNR was a significant advance and is still an excellent source of nematode resistance in cotton, it is now generally considered to

be obsolete when compared with the yield and fiber quality of newer cultivars. Six germplasm lines that suppressed reproduction of *M. incognita* by 80–94% and had improved yield and fiber quality were released in 2006 (Haire, 2006; Creech et al., 2007).

GA 120R1B3 (Reg. No. GP-931, PI 660980) was jointly developed and evaluated by the USDA-ARS and the Agricultural Experiment Station at the University of Georgia, who jointly released it in 2010. This line was developed to provide public and private breeders with an agronomically improved source of resistance to *M. incognita*. GA 120R1B3 derives its nematode resistance from M-120 RNR and its yield and fiber quality characteristics from PD 94042 (Reg. No. GP-695, PI 603219).

Methods

Resistance to *M. incognita* was incorporated from M-120 RNR into the susceptible PD 94042. PD 94042 has high yield potential, a high lint percentage, and improved fiber maturity (May, 1999). Following the initial M-120 RNR/PD 94042 cross to create the F₁ generation, individual plants with the greatest levels of resistance were backcrossed into PD 94042 for three generations followed by eight generations of self-pollination with selection of only the most resistant plants that were carried to the next generation. All crosses and selection through the BC₃F₈ generation were made under controlled conditions in a greenhouse.

A single-seed descent method was used, and plants in each generation were selected individually for resistance by the following multistep process. Seeds were planted at 1 seed per pot in a greenhouse. Approximately 3 wk after seedling emergence, each pot was infested with 8000 eggs of *M. incognita* that had been extracted from culture plants

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Table 3. Comparison of GA 120R1B3 cotton germplasm to resistant and susceptible standards in fields in 2008 not infested with *Meloidogyne incognita*, the southern root-knot nematode.

| Genotype [†] | Yield kg ha ⁻¹ | Lint % | Length cm | Strength g tex ⁻¹ | Micronaire units |
|-----------------------|------------------------------|--------|--------------|---------------------------------|---------------------|
| 2008 pooled | | | | | |
| GA 120R1B3 | 765 [‡] | 45.5 | 3.00 a | 32.1 b | 4.98 a |
| DP 147 RF | 772 | 42.9 | 3.02 a | 33.5 b | 4.90 a |
| FM 966 | 869 | 41.7 | 2.90 a | 38.2 a | 5.00 a |
| 2008 Plains | | | | | |
| GA 120R1B3 | 528 b | 43.7 a | 3.00 | 32.4 | 4.85 |
| DP 147 RF | 665 b | 41.8 b | 3.05 | 32.9 | 4.95 |
| FM 966 | 918 a | 41.3 b | 2.87 | 36.3 | 5.05 |
| 2008 Tifton | | | | | |
| GA 120R1B3 | 1002 a | 47.4 a | 3.00 | 31.7 | 5.10 |
| DP 147 RF | 877 ab | 44.1 b | 3.00 | 34.1 | 4.85 |
| FM 966 | 775 b | 42.0 c | 2.92 | 40.2 | 4.95 |

[†]DP 147 RF and FM 966 are susceptible cultivars standards.

[‡]Means followed by the same letter within a column do not differ (LSD_{0.05}). If the pooled data indicates trait by location interaction, the mean separations are shown for specific location.

Table 4. Comparison in 2009 of GA 120R1B3 cotton germplasm to resistant and susceptible standards as well as the backcross parent PD 94042 in fields not infested with *Meloidogyne incognita*, the southern root-knot nematode.

| Genotype [†] | Yield kg ha ⁻¹ | Lint % | Length cm | Strength g tex ⁻¹ | Micronaire units |
|-----------------------|------------------------------|--------|--------------|---------------------------------|---------------------|
| 2009 pooled | | | | | |
| GA 120R1B3 | 572 [‡] | 44.6 a | 3.12 a | 31.6 | 4.45 b |
| DP 147 RF | 524 | 42.2 b | 3.15 a | 31.2 | 4.20 a |
| FM 966 | 529 | 42.0 b | 3.05 a | 36.2 | 4.58 b |
| PD 94042 | 413 | 44.0 a | 3.05 a | 32.2 | 4.65 b |
| 2009 Plains | | | | | |
| GA 120R1B3 | 757 a | 44.9 | 3.18 | 31.2 b | 4.46 |
| DP 147 RF | 656 ab | 42.2 | 3.15 | 30.4 b | 4.31 |
| FM 966 | 585 bc | 42.7 | 3.15 | 38.7 a | 4.65 |
| PD 94042 | 468 c | 43.8 | 3.02 | 31.2 b | 4.75 |
| 2009 Tifton | | | | | |
| GA 120R1B3 | 385 b | 44.4 | 3.10 | 31.9 b | 4.44 |
| DP 147 RF | 393 ab | 42.1 | 3.18 | 31.9 b | 4.09 |
| FM 966 | 473 a | 41.2 | 2.95 | 33.6 a | 4.51 |
| PD 94042 | 348 b | 44.3 | 3.05 | 33.3 ab | 4.54 |

[†]DP 147 RF and FM 966 are susceptible cultivars standards. PD 94042 is the backcross parent.

[‡]Means followed by the same letter within a column do not differ (LSD_{0.05}). If the pooled data indicates trait by location interaction, the mean separations are shown for specific location.

in Tifton, the yield of GA 120R1B3 was similar to DP 147 RF and less than FM 966 (Table 4). The yields in Tifton in 2009 were relatively low due to late planting. To summarize, GA 120R1B3 and DP 147 RF have similar yields, but FM 966 appears to be more variable and its yield was better or worse depending on the season. FM 966 was intended to serve in these trials primarily as a comparison for fiber quality.

GA 120R1B3 grown in fields infested with *M. incognita* had an excellent lint percentage, length, and micronaire, which were similar to or better than those of the commercial checks (Table 2). Cotton fiber that is generally equivalent in quality to FiberMax cultivars may get premium value in the market. Along with a very attractive micronaire and a very good lint percentage, GA 120R1B3 grown under stress from *M. incognita* still had a fiber length (3.18 cm that almost met the standard to be considered extra long (upper half mean [UHM] > 3.2 cm).

Even though there was a significant location by lint percentage interaction for the noninfested fields in Plains and Tifton in 2008, GA 120R1B3 had a greater lint percentage than did DP 147 RF or FM 966 in every location and year (Tables 3 and 4). For the fiber-quality measures, neither year showed a location by entry interaction except for strength in 2009 (Tables 3 and 4). Even then, the strength ranking of GA 120R1B3 and the checks were the same in both locations. The fiber of GA 120R1B3 is considered to be strong. The length of GA 120R1B3 and of the checks was not significantly different across locations for 2008 or 2009 (Tables 3 and 4). From the available data for PD 94042 in 2009 from the noninfested yield test, GA 120R1B3 was a better-yielding germplasm for both Georgia locations than was PD 94042 (Table 4). GA 120R1B3 retained the long length, high lint percentage, strong fiber strength, and nondiscouraging micronaire that it inherited from its recurrent parent, PD 94042 (Table 4). GA 120R1B3 can be considered desirable due to its fiber length and lint percentage in either infested or noninfested fields. The pooled micronaire (Tables 3 and 4) was acceptable in the base range over both locations and years even though it trended high in 2008.

In summary, GA 120R1B3 is a line with a high level of resistance to *M. incognita* and good adaptability to Georgia's production environments as demonstrated by yields comparable to commercial cultivars and its recurrent parent. It also has a high lint percentage and excellent fiber quality in both the presence and absence of *M. incognita*.

Availability

Small quantities of seed may be obtained for breeding purposes from the corresponding author. Request for seed from outside the USA must also be accompanied by an import permit allowing entry into the requestor's country. The USDA-ARS may not be able to certify that seed are free of certain insects or pathogens specified on import permits, and in such cases seed cannot be supplied. Seed of this release has also been deposited in the National Plant Germplasm System. It is requested that appropriate recognition of the source be given when this germplasm line contributes to the development of a new breeding line, hybrid, or cultivar.

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Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the USDA or the University of Georgia. The authors thank Cotton Incorporated and the Georgia Cotton Commission for partial support of this work.

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