

APPLICATION FOR RELEASE

APPLICATION FOR RELEASE OF (check one):

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|--|--|
| <input checked="" type="checkbox"/> CULTIVAR | <input type="checkbox"/> PARENTAL LINE |
| <input type="checkbox"/> ASSOCIATE CULTIVAR | <input type="checkbox"/> GENETIC STOCK |
| <input type="checkbox"/> GERMPLASM | |

1. Crop: Peanut (*Arachis hypogaea* L.)
2. Experimental no. or name: GA 192710
3. Pedigree and history: GA 192710 was developed from a cross made in 2015 between two runner-type parents, 'Georgia-06G' and GA 122704. GA 122704 is a high-oleic RKN-resistant advanced Georgia breeding line derived from a cross between 'Tifguard' and 'Georgia-02C'. Pedigree selection was practiced within the early segregating populations (F₂-F₅). Yield tests have been conducted for the past three years (2021-23) compared to other check cultivars.
4. Description of plant material: GA 192710 is being proposed for release as a new very high-oleic, root-knot nematode (RKN) resistant, large-seeded, runner-type peanut cultivar. It has an intermediate decumbent runner growth habit and medium+ maturity, and dark green leaves (Fig. 1). It also has a high level of resistance to tomato spotted wilt virus (TSWV) and root-knot nematode (RKN). For the past five years (2019-2023), field observations and data indicate that these characteristics of GA 192710 are very uniform and stable, and no off-types or variants have been found.
5. Need for and potential users of plant material: This potential new cultivar has very good stability, and combines the very high-oleic trait with TSWV and RKN-resistance, high-yield, grade, and dollar value. Possibly several peanut seed companies, manufacturers, and growers should be interested in the use of this plant material.
6. Justification for release:
 - A. During the past three-years (2021-23) averaged over 13 different tests across multilocations in Georgia, GA 192710 was found to have significantly lower total disease (TD) incidence compared to the similar high-oleic and RKN-resistant cultivar, 'Georgia-14N' (Table 1). GA 192710 also has a significantly higher yield and dollar value with lower seed count (larger seed size) as compared to the Georgia-14N cultivar, but similar high TSMK grade percentage.
 - B. During the past two-years (2022-23) averaged across multiple locations in Georgia (Tables 2-4), GA 192710 was again found to have among the lowest TSWV and total disease (TD) incidence and among the highest pod yield and dollar value when compared to two RKN-resistant, high-oleic, runner-type peanut cultivars, Georgia-14N and 'TifNV-High O/L'. In 2023, it was also significantly higher in TSMK grade compared to TifNV-HG (Tables 3 and 4), but similar in seed count compared to this large-seeded,

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high-oleic, RKN-resistant, runner-type cultivar, TifNV-HG.

- C. During 2023 at Attapulgus, GA, GA 192710 was found^a to have very high RKN resistance similar to Georgia-19HP and Georgia-14N (Table 5). GA 192710 was also significantly higher than Georgia-14N in pod yield.
- D. During three-years (2021-23), GA 192710 was found to have a significantly larger percentage of fancy pods than Georgia-14N, similar to Georgia-19HP (Table 6). No significant differences were found for jumbo runner seed size distribution (Table 7), however GA 192710 and Georgia-14N had significantly higher percentages of meat content than Georgia-19HP.
- E. GA 192710 was found to have a significantly higher oleic (O) to linoleic (L) fatty acid ratio than Georgia-14N, Georgia-19HP, and the normal-oleic cultivar, Georgia-06G (Table 8). GA 192710 was also found to have similar good peanutty flavor and sweet taste flavor scores as Georgia-06G, Georgia-19HP, and Georgia-14N.

- 7. Participating scientists: W. D. Branch
- 8. Location(s) at which plant material was developed: Coastal Plain Experiment Station
- 9. Recommended form of intellectual property protection and royalty:
U.S. Utility Patent and Plant Variety Protection (PVP) with royalty

Cultivar and associate cultivar applications only provide the following information:

- 10. Method of propagation: Seed
- 11. Amount of breeder seed stocks available (if applicable): 50 lbs
- 12. Amount of foundation seed stocks available if applicable: >1,000 lbs
- 13. Amount of cutting or bud material available for vegetatively propagated material for nursery distribution (if applicable): N/A
- 14. Describe any unusual difficulty anticipated in the production of any class of seed stocks: None
- 15. Suggest up to three names for the cultivar, if appropriate:
'Georgia-24NHO' (Name preferred by the breeder).
- 16. Name approved by plant cultivar and germplasm release committee:

(Please keep this as a separate page)

Application for the cultivar release of the advanced peanut breeding line, GA 192710.

Recommended:

- A.

DocuSigned by: <i>Dr. William D. Branch</i>	08/08/2024 11:05 AM EDT
616F24360F91482 Originating Scientist	Date

- B.

DocuSigned by: <i>[Signature]</i>	08/09/2024 3:54 PM EDT
B25E83E698BB409... Department Head	Date

- C.

DocuSigned by: <i>Dr. Michael Toews</i>	08/09/2024 1:57 PM PDT
E4D20D0A2912483... For Griffin and Tifton, Assistant Dean	Date

- D.

DocuSigned by: <i>Wayne Parrott</i>	08/09/2024 5:09 PM EDT
FAF3B98C66534FF... Chair, GAES PCGRC	Date

- E.

DocuSigned by: <i>Dr. Harsha Thippareddi</i>	08/09/2024 2:10 PM PDT
6C53D194ADCE4D5... Associate Dean for Research	Date

Approved:

- F.

DocuSigned by: <i>Dr. Harsha Thippareddi</i>	08/09/2024 2:10 PM PDT
6C53D194ADCE4D5... Dean and Director	Date

REGISTRATION

Cultivar

Registration of 'Georgia-24NHO' peanut

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Assigned to Associate Editor Shyam Tallury.

Registration by CSSA.

Abstract

'Georgia-24NHO' (Reg. no. CV-160, PI 706577) is a new high-yielding, very high-oleic, *Tomato spotted wilt virus* (TSWV)-resistant, and root-knot nematode (RKN) [*Meloidogyne arenaria* (Neal) Chitwood]-resistant, large-seeded, runner-type peanut (*Arachis hypogaea* L. subsp. *hypogaea* var. *hypogaea*) cultivar that was released by the Georgia Agricultural Experiment Station in 2024. It was developed at the University of Georgia, Tifton Campus. Georgia-24NHO originated from a cross made between 'Georgia-06G' × GA 122704. Georgia-06G is a normal-oleic, TSWV-resistant, large-seeded, runner-type peanut cultivar. GA 122704 is a high-oleic, RKN-resistant, advanced Georgia breeding line. Pedigree selection was practiced within the early segregating generations. Performance testing began in the F_{4:6} generation with the advanced pure-line selection, GA 192710. During the past 3 years (2021–2023) averaged over 13 multiple location tests without nematode pressure in Georgia, Georgia-24NHO had significantly less total disease incidence than 'Georgia-14N'. Georgia-24NHO was also found to have a larger runner seed size as compared to the smaller runner-type check cultivar, Georgia-14N. Georgia-24NHO combines high-yield, TSWV-resistance, and RKN-resistance with large seed size and the very high-oleic trait for longer shelf-life and improved oil quality of peanut and peanut products.

Plain Language Summary

Georgia-24NHO is a new high-yielding peanut cultivar. It also has high tomato-spotted wilt virus (TSWV) resistance and a very high root-knot nematode (RKN) resistance. Georgia-24NHO is a large-seeded runner market-type with a very high-oleic fatty acid ratio for longer shelf-life.

Abbreviations: FSIS, federal-state inspection services; TD, total disease; O/L ratio, oleic to linoleic fatty acid ratio; RKN, root-knot nematode; SMK, sound mature kernels; TSWV, *Tomato spotted wilt virus*; UGA, University of Georgia.

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1 | INTRODUCTION

'Georgia-24NHO' (Reg. no. CV-160, PI 706577) is a high-yielding, very high-oleic, *Tomato spotted wilt virus* (TSWV)-resistant and root-knot nematode (RKN) [*Meloidogyne arenaria* (Neal) Chitwood race I]-resistant, large-seeded, runner-type peanut (*Arachis hypogaea* L. subsp. *hypogaea* var. *hypogaea*) cultivar that was released by the Georgia Agriculture Experiment Station in 2024. It was developed at the University of Georgia, Coastal Plain Experiment Station, Tifton, GA. Georgia-24NHO was experimentally tested as GA 192710.

Georgia-24NHO was selected from a cross made in 2014–2015 between 'Georgia-06G' (Branch, 2007) and GA 122704. Georgia-06G is a normal-oleic, TSWV-resistant, large-seeded, runner-type peanut cultivar that was developed from a cross between 'Georgia Green' (Branch, 1996) and 'C-99R' (Gorbet & Shokes, 2002). Georgia Green originated from a cross between 'Southern Runner' (Gorbet et al., 1987) and 'Sunbelt Runner' (Mixon, 1982). Georgia Green has TSWV-resistance and was found to have among the highest best linear unbiased prediction (BLUP) breeding values for roasted peanut and sweet flavor attributes in a large multi-state, 5-year study (Pattee et al., 2003). GA 122704 is a high-oleic, RKN-resistant, advanced Georgia breeding line that was derived from a cross between 'Tifguard' (Holbrook et al., 2008) and 'Georgia-02C' (Branch, 2003). Georgia-02C is a medium-seeded, runner-type cultivar which was released in 2002 with resistance to TSWV and *Cylindrocladium* black rot (caused by *Calonectria ilicicola* syn. *Cylindrocladium parasitium* Crous, Wingfield, Alfenas). Georgia-02C originated from a cross made in 1993 between Southern Runner and a Georgia high-oleic selection derived by γ -irradiation induced mutation from seed of 'Georgia Runner' (Branch, 1991).

C-99R was developed from a cross between two Florida breeding lines, UF 81206-1 and F72 \times 32B-13-1-3-b2-B. It also has good multiple disease resistance. Tifguard was developed by crossing C99R \times 'COAN' (Simpson & Starr, 2001). COAN has a very high-level of peanut RKN resistance. However, Tifguard combines both TSWV and RKN resistance.

Georgia-24NHO is intended for the same US domestic market as these other high-oleic, runner-type peanut cultivars. It was developed by conventional breeding and did not involve any genetically modified organisms. Georgia-24NHO combines the very high-oleic trait for longer shelf-life of runner-type peanut cultivars with high-yield, large seed size, and a high-level of nematode resistance.

2 | METHODS

Georgia-24NHO was developed using the pedigree selection method for peanut breeding (Knauft et al., 1987). In 2015,

F₁ seed were space-planted approximately 122 cm apart in one-row plots, 6.1-m long \times 1.8-m wide at the Gibbs research farm near the University of Georgia (UGA) Coastal Plain Experiment Station, Tifton campus. F₂, F₃, and F₄ seed were space-planted the following 3 years (2016–2018) in nursery field tests approximately 30.5 cm apart in two-row plots, 6.1-m long \times 1.8-m wide. Individual plant selections were made based upon high-oleic oil chemistry, pod shape, seed size, testa color, growth habit, maturity, pod yield, and grade characteristics. During the segregating early-generations (F₂–F₄), individual plants were selected for TSWV resistance.

The F_{4,5} progeny rows were space-planted approximately 30.5 cm between seeds in two-row plots, 6.1-m long \times 1.8-m wide. Progeny rows were selected based upon the same selection criteria used during the early generations, including RKN resistance based upon marker assisted selection (MAS). Individual progeny rows were bulked as pure-lines for subsequent preliminary yield tests. Georgia-24NHO was designated as GA 192710 for further testing.

Yield and other agronomic traits were evaluated using randomized complete block designs in field trials conducted for 3 years (2021–2023) at multiple locations in Georgia. Plots consisted of two-rows 6.1-m long \times 1.8-m wide with row spacing 0.8 m within rows and 1.0 m between rows on adjacent plots. Thirteen total tests were planted between mid-April and mid-May at 6 seeds 30.5 cm⁻¹ during the 3-year comparisons. Production practices included conventional tillage, fertilization, recommended pesticides and rates, irrigated, and non-irrigated. These field trials were in a 3-year rotation following cotton (*Gossypium ssp.*) and corn (*Zea mays* L.). Entries were dug near optimum maturity each year based upon hull-scrape determination from adjacent border plots (Williams & Drexler, 1981).

Disease incidence of TSWV was first assessed at mid-season, when TSWV is usually the only disease evident at approximately 70 days after planting. Percentages (0–100%) of total disease (TD) incidence within each two-row plot (no. hits 12.2 m⁻¹) were scored prior to digging, which included primarily TSWV but also any soilborne disease present, primarily stem rot caused by *Agroathelia rolfsi*. A disease hit equaled one or more symptomatic plants within a 30.5-cm section of row.

RKN evaluations were conducted at a highly infected RKN field site at the UGA Research and Education Center near Attapulgus, GA. The field has been in continuous peanuts, and the soil was a Bonneau loamy sand (Loamy, siliceous, subactive, thermic Arenic Paleudult). Tests were planted in mid-May, and conventional production practices were used except for nematocides. After digging and inverting, visual root gall ratings were estimated from 0 to 100%, with 0% representing no galls and 100% representing galling on all pods and roots. Prior to digging, soil samples were taken within each plot to obtain the number of juvenile RKN cm³ soil⁻¹.

TABLE 1 Three-year (13 tests) average disease incidence, pod yield, total sound mature kernels (TSMK), seed weight, and dollar values of Georgia-24NHO and two other high-oleic, *Tomato spotted wilt virus* (TSWV) and root-knot nematode-resistant peanut cultivars at multi-locations in Georgia, 2021–2023.

Peanut cultivar ^a	TSWV (%)	TD (%)	Yield (kg ha ⁻¹)	TSMK (%)	Seed weight (g 100 ⁻¹)	Value (\$ ha ⁻¹)
Georgia-24NHO	11 a	25 b	5429 a	76 a	71 b	2204 a
Georgia-19HP	9 b	22 b	5270 a	73 b	72 b	2202 a
Georgia-14N	10 ab	31 a	4728 b	76 a	58 a	1895 b

Note: Means within the columns followed by the same letter are not significantly different at $P \leq 0.05$.

Abbreviation: TD, total disease.

^aAll three listed cultivars in this table are high-oleic.

Six cores per plot about 15-cm deep were mixed, kept refrigerated, and sent to the UGA Nematology Lab for evaluation at the Athens main campus.

After digging and picking, pods and seed were dried with forced warm air to 6% seed moisture content. Pod samples were then hand-cleaned over a screen table before weighing for yield, shelling, and grading. In the grading process using Federal-State Inspection Service (FSIS) procedure, total sound mature kernels (TSMK) equal the sum of sound mature kernels (SMK) and sound splits. SMK equals the percentage of sound mature seed excluding damaged and split seed riding a minimum runner slotted screen size of $\geq 6.35 \text{ mm} \times 19.05 \text{ mm}$ (USDA-ARS, 1998). Dollar values were calculated from USDA peanut loan schedules for each crop year and were based upon yield and grade factors to obtain a gross dollar value return per hectare.

After shelling, seed samples were screened over a $\geq 7.14 \text{ mm} \times 19.05 \text{ mm}$ screen for SMK and hand-picked for only edible seed. A 454-g sample was taken from each replication and sent to J. Leek Associates International testing laboratory at Edenton, NC, for sensory flavor test evaluation. Each sample was dry roasted to medium roasted peanut color (Hunter L 48 ± 2). The roasted peanut seed were then blanched and ground into a paste for flavor evaluations by a trained sensory panel.

Ten SMK of each runner-type peanut cultivar were also sent to the W. M. Leek Metabolism Research Laboratory at Iowa State University. Fatty acid methyl esters were determined by gas chromatography as a percentage of the total oil composition. The oleic to linoleic (O/L) fatty acid ratios were then used to separate cultivar differences.

Data for each variable were subjected to analyses of variance (ANOVA). Waller–Duncan's T-test (k -ratio = 100) was used for mean separation involving three or more entries (Tables 1–3).

3 | CHARACTERISTICS

Georgia-24NHO is a large-seeded, US runner market type peanut cultivar belonging to subsp. *hypogaea* var. *hypogaea*

(Hammons, 1973; Krapovickas & Gregory, 2007). Similar to all other runner market types, it differs from the US virginia market-type cultivars which also belong to the same sub-species and botanical variety by having smaller pod and seed size. To distinguish between these two market-types, virginia-type peanut must contain $\geq 40\%$ fancy pods after sized over a FSIS pod presizer for virginia pods. Also, shelled virginia extra-large kernels (ELK) should be ≤ 512 count per 454 g after being screened over a $8.53\text{-mm} \times 25.4\text{-mm}$ slotted screen opening (USDA-ARS, 1979). Many current large-seeded, runner-type cultivars likewise meet the $\geq 40\%$ fancy pods, however none contain ≤ 512 count or $\geq 88.6 \text{ g } 100^{-1}$ ELK, including Georgia-24NHO after shelling.

Georgia-24NHO is most similar to the RKN-resistant cultivar, 'Georgia-14N' (Branch & Brenneman, 2015). However, it had significantly ($P \leq 0.05$) less TD incidence, higher pod yield, and greater dollar value return per hectare than Georgia-14N (Table 1). It is also distinctively different from Georgia-14N in having a significantly larger seed weight (Table 1).

In a field test conducted in a highly infected RKN field location at Attapulgus during 2023 (Table 2), Georgia-24NHO, 'Georgia-19HP' (Branch & Brenneman, 2020), and Georgia-14N were found to have significantly fewer number of RKN and lower percentage of root galling compared to the susceptible check cultivar, 'Georgia-07W' (Branch & Brenneman, 2008). The pod yield of RKN-resistant cultivars, Georgia-19HP, Georgia-24NHO, and Georgia-14N were also found to have significantly higher yield compared to Georgia-07 W.

Georgia-24NHO also has a significantly higher O/L ratio and similar flavor scores to Georgia-14N, Georgia-19HP, and Georgia-06G (Table 3). The very high O/L ratio ($>40:1$) found in Georgia-24NHO is similar to the very High-O/L genotypes reported earlier (Branch et al., 2020). Allelism testcrosses of High \times High-O/L and Very High \times Very High O/L results suggest that there are at least two different high-oleic genotypes in peanut. Georgia-24NHO thus combines high-yield, grade, and dollar value with TSWV- and RKN-resistance with large-seed size and the very high O/L fatty acid ratio oil trait for longer shelf-life and improved quality of peanut and peanut products.

TABLE 2 Average *Tomato spotted wilt virus* (TSWV), total disease (TD) incidence, root-knot nematode (RKN) count, root gall rating, and pod yield of Georgia-24NHO vs RKN-susceptible check cultivar (Georgia-07 W) and two other RKN-resistant (Georgia-19HP and Georgia-14N) cultivars in a highly infected RKN field test at Attapulgus, GA, 2023.

Runner cultivar	TSWV ^a (%)	TD ^b (%)	RKN ^c (no.)	Gall Rating ^d (0–100%)	Pod Yield (kg ha ⁻¹)
● Georgia-19HP	15.0 b	32.5 b	36.5 b	2.0 b	4330 a
● Georgia-24NHO	15.0 b	35.6 b	55.6 b	2.0 b	3963 ab
● Georgia-14N	25.6 ab	48.4 ab	36.5 b	1.5 b	3460 b
Georgia-07 W (check)	35.6 a	65.0 a	1989.0 a	67.5 a	1729 c

Note: Means within the same columns followed by the same letter are not significantly different at $P \leq 0.05$. ● High-Oleic.

^aPercentage of row feet infected based upon disease loci (30.5 cm of linear row) per plot of TSWV incidence at about mid-season.

^bPercentage of row feet infected based upon disease loci (30.5 cm of linear row) per plot of TD incidence prior to digging, primarily TSWV and some soilborne diseases.

^cNumber of RKN juvenile per 100 cm³ of soil.

^dVisual rating of the percentage of roots (0–100%) per plot with damage from RKN.

TABLE 3 Average roasted peanutty flavor, sweet taste flavor and oleic (O) to linoleic (L) fatty acid ratio of Georgia-24NHO vs three other peanut cultivars, 2022.

Runner cultivar	Roasted peanutty flavor ^a	Sweet taste flavor ^a	O/L Ratio
● Georgia-24NHO	6.2 a	2.6 a	40.3 a
● Georgia-14N	6.0 a	2.1 b	33.4 b
● Georgia-19HP	6.1 a	2.5 ab	26.8 c
Georgia-06G	6.1 a	2.5 ab	2.5 d

Note: Within columns, means followed by the same letter are not significantly different at $P \leq 0.05$. ● High-Oleic.

^aRoasted peanutty and sweet taste flavor scores are on a 0–10 scale, where 0 = none and 10 = strong peanut intensity. A good roasted peanutty score is 5–7 if free of off flavors.

4 | AVAILABILITY

US Plant Variety Protection (PVP) and US Utility Patent is pending for Georgia-24NHO. Breeder seed of Georgia-24NHO will be maintained by the University of Georgia, Coastal Plain Experiment Station at Tifton, GA. Foundation seed stock will be available from the Georgia Seed Development Commission, 2420 S. Milledge Ave., Athens, GA 30605. Genetic material of this release has been deposited in the USDA-ARS National Plant Germplasm System, where it will be available for research purposes on expiration of PVP and Utility Patent.

AUTHOR CONTRIBUTIONS

William D. Branch: Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization; writing—original draft; writing—review and editing. **Nino Brown:** Investigation; methodology; resources; writing—review and editing. **Timothy B Brenne-**
man: Data curation; investigation; methodology; supervision; writing—review and editing.

CONFLICT OF INTEREST STATEMENT

The authors report no conflicts of interest.

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