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Pait et al.

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(54) **LOBLOLLY PINE TREE NAMED 'CF Q7766'**

(50) Latin Name: ***Pinus taeda***
Varietal Denomination: **CF Q7766**

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(65) **Prior Publication Data**

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(51) **Int. Cl.**
A01H 7/00 (2006.01)

(52) **U.S. Cl.** **Plt./213**

(58) **Field of Classification Search** Plt./213
See application file for complete search history.

(56) **References Cited**

PUBLICATIONS

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http://www.cnr.vt.edu/DENDRO/dendrology/syllabus/factsheet.cfm (1 page).*
U.S. Appl. No. 11/635,703, Pait et al., filed Dec. 7, 2006.
United States Patent Office Action for U.S. Appl. No. 11/635,703 dated Jan. 18, 2008.

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(57) **ABSTRACT**

A new and distinctive variety of a loblolly pine tree which has been denominated varietally as 'CF Q7766' which is distinguished by great resistance to fusiform rust and pitch canker, exceptionally high growth rate, excellent stem straightness, distinctive very long internodes, narrow crown.

2 Drawing Sheets

Latin name: *Pinus taeda.*
Variety denomination: 'CF Q7766'.

BACKGROUND

A new variety of loblolly pine tree (*Pinus taeda*), has been discovered. This selection has been designated as 'CF Q7766.'

This new variety is a progeny of a second generation selection pollinated by a first generation selection. Female parent is an open pollinated progeny of Georgetown County, S.C. first generation selection. Male parent is a first generation selection made in Barnwell County S.C.

Cross pollination occurred in early 1998 followed by induction and cryopreservation of embryogenic tissue in 1999. First somatic seedlings were produced in 2000 and planted in early 2001 in seven field experiments. A total of 47 ramets (independent members of a clone) were planted ranging from 4 to 8 ramets per field experiment. The field experiments are located in Mississippi, Florida, Georgia and South Carolina.

BRIEF SUMMARY

A new and distinct cultivar of loblolly pine (*Pinus taeda*) is distinctly characterized by great resistance to fusiform rust and pitch canker, exceptionally high growth rate, excellent stem straightness, distinctive very long internodes, narrow crown, and which is mature for commercial harvesting sooner than conventionally grown trees under the ecological conditions prevailing in the Piedmont, Atlantic and Gulf

Coastal Plains, and Mid-Continent regions of the United States.

The *Pinus taeda* plants of this variety were asexually propagated using an advanced form of micropopagation called somatic embryogenesis carried out at CellFor's production facility in Victoria, Canada. Somatic embryogenesis uses a complex process which relies on the splitting of one embryo into many identical embryos. Somatic embryos can then be grown into plants which are all identical genetically. The asexual propagation occurs at an earlier stage in the plant's life cycle than most other micropropagated plants. The detailed methods for somatic embryogenesis used for asexually propagating conifers in general are described in U.S. Pat. No. 6,372,496 and for loblolly pine in particular in U.S. patent application 2004/0203150.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings are color photographs showing the new variety of loblolly pine including the long internode length.

FIG. **1** is a photograph showing 'CF Q7766' ramet # 7 planted in Holt, Ga. The picture was taken after five field growing seasons. The picture shows distinctive long stem sections of clearwood between the whorls (long internodes), small to medium branch size (relative to the stem size), flat to medium angle between the branches and the stem and great stem straightness.

FIG. **2** is a photograph showing 'CF Q7766' ramet # 4 planted in Winokur, Ga. The picture was taken after five field growing seasons. The picture shows superiority of growth, narrow tree crown relative to the size of this tree and the size

of surrounding neighbors, and distinctive long internodes seen particularly well in the upper crown.

DETAILED BOTANICAL DESCRIPTION

The botanical details of this new and distinct variety of loblolly pine tree follow. All color descriptions are made in reference to The Royal Horticultural Society (R.H.S.) Colour Chart (2005).

Parentage: Female parent: (Unknown) open pollinated progeny of a first generation selection of Georgetown County, S.C. Male parent: (Unknown) first generation selection of Barnwell County, S.C.

Compared to unimproved loblolly pine trees, 'CF Q7766' is characterized by exceptionally high growth rate, great resistance to fusiform rust (caused by *Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *fusiforme* (Cumm.) Burds. et Snow), great resistance to pitch canker (caused by *Fusarium circinatum* Nirenburg et O'Donnell), distinctive very long internodes, excellent stem straightness, narrow crown, small to medium branch diameter, flat to medium branch angle and low incidence of forking.

Disease resistance:

Percent stem fusiform rust infection at age 5.—0.

Percent branch fusiform rust infection at age 5.—5.

Percent branch and stem fusiform rust infection at age 5.—0.

Percent dead ramets due to fusiform rust infection at age 5.—0.

Percent stem fusiform rust infection in the USDA Resistance Screening Center (Asheville, N.C.) tests after artificial inoculation with rust spores.—5% (compared to 78% infection in unimproved seedlings).

Percent of seedlings with over 50% *of tissue infected by pitch canker in the USDA Resistance Screening Center (Asheville, N.C.) tests after artificial inoculation with pitch canker spores.*—1% (compared to 99% infection in unimproved seedlings).

Botanical description:

Shape.—A medium to large tree may reach well over 100 feet tall, self-prunes well and develops a fairly straight trunk and an oval, somewhat open crown.

Average height.—28 ft after 5 field growing seasons.

Maximum height.—34 ft after 5 field growing seasons.

Average trunk diameter at breast height (4.5 *feet above the soil level*).—4.7 inches after 5 field growing seasons, 6.7 inches to 7.1 inches after seven field growing seasons.

Maximum trunk diameter at breast height (4.5 *feet above the soil level*).—6.4 inches after 5 field growing seasons.

Percent stem forking at age 4.—2.

Percent stem straightness gain over unimproved trees.—15.

Bark.—Initially red- to gray-brown and scaly; older trees are ridged and furrowed, with somewhat rounded scaly plates. The RHS color is 200C in shade and 187D on exposure to sun.

Branch.—Orange-brown in color, fine to moderately stout; buds are narrowly ovoid, light reddish brown.

Percent ramets with ramicorn branches at age 4.—2.

Sampling of branch characteristics.—In order to sample branches from a consistent position from one tree to the next the following methodology was utilized. From a point nine feet from the base of the tree, the first complete whorl of limbs below was labeled "Whorl One" and the first complete whorl of limbs above labeled "Whorl Two". This sampling point was chosen because it is the midpoint of the basal sixteen foot log of each tree. A complete whorl was defined as one with at least three branches. An average whorl contained 2–7 branches. All measurements were taken commencing on the South side of the tree and progressing anticlockwise around the stem. When more than three branches were available for measurement on the whorl the largest three branches, by basal diameter, were used for sampling. The following branch characteristics were measured after seven field growing seasons.

Branch diameter.—Diameter of each measured branch was taken at its base. Using a caliper the diameter of the branch, over bark, was measured to the closest 100^{th} of an inch. 'CF Q7766' has an average branch diameter of 1.00 inches at the base of the branch. Zygotic seedlings of the same genetic origin have an average branch diameter of 1.24 inches at the base of the branch.

Branch Angle.—Utilizing a large protractor, the angle of each branch was measured as its deviation from horizontal. Branch angles were recorded for the portion of the branch emerging from the stem of the tree with data rounded to the closest 10 degrees. 'CF Q7766' has an average branch angle of 35.0 degrees from horizontal. Zygotic seedlings of the same genetic origin have an average branch angle of 43.3 degrees from horizontal.

Branch length.—The length of each sampled branch was measured directly with a graduated measurement pole. Branch lengths were recorded to the closest 0.5 feet. 'CF Q7766' has an average branch length of 6.48 feet. Zygotic seedlings of the same genetic origin have an average branch length of 9.17 feet.

Crown diameter.—The width of the crown, at the point where branch measurements were taken, was directly measured with the use of a graduated measurement pole. A radial measurement was taken on the East and West side of each tree. Crown radius was measured to the closest 0.5 feet. Crown width data is presented as diameter of the crown. 'CF Q7766' has an average crown diameter of 7.8 feet. Zygotic seedlings of the same genetic origin have an average crown diameter of 11.5 feet.

Internode length.—In proximity to the area of the stem utilized for branch measurements the mean internode length was determined for each tree. Internode distances for the calculation of the mean were directly measured from the stem of the tree using a graduated measurement pole. 'CF Q7766' has an average internode length of 3.12 feet. Zygotic seedlings of the same genetic origin have an average internode length of 2.25 feet.

Leaf.—Evergreen needles, 6 to 9 inches long, with (usually) three yellow-green needles per fascicle. The color of the foliage was measured at age 1 year and age 7 years and was found not to vary significantly with age. The color of the foliage was RHS 137A (40%) and 137C (60%). Diameter of the fascicle was $^{6}/_{100}$ of an inch and the average sheath length is 6.75 mm.

Flower.—Monoecious; males long cylindrical, red to yellow, in clusters at branch tips; females yellow to purple.

Fruit.—Ovoid to cylindrical, 3 to 6 inch red-brown cones; umbo is armed with a short spine, maturing in early fall. Cones are sporadic in 5–7 year old plants.

Propagation.—Propagated by somatic embryogenesis.

Seeds.—none produced yet at 5–7 years of age, plants are not yet mature. Expected seed production by 12–15 years.

Use.—High yield industrial plantations

Although the new variety of loblolly pine tree possesses the detailed characteristics noted above as a result of the growing conditions prevailing in the seven test locations, it is to be understood that the variations of the usual magnitude and characteristics incident to changes in growing conditions, irrigation, fertilization, pruning, pest control, climatic variations and the like are to be expected. An example of 'CF Q7766' resulting from asexual reproduction can be found at Plum Creek Oliver year 2001 line trial, Screven county, Ga.

COMPARISON WITH PARENTS BY MICROSATELLITE ANALYSIS

Microsatellite markers were used to generate a unique DNA fingerprint for the variety. Vegetative buds and/or foliar material from eight individuals each produced by controlled crossing among parents for DNA fingerprinting. The DNA extraction protocol of Doyle and Doyle (1987) was used after slight modifications. DNA fingerprinting of parents and their offspring was initially conducted using a set of nine microsatellite markers (Auckland et. al. 2002) and a final set of five primer pairs were selected for the two lines mentioned above (see Table 1, for sequences and conditions of SSR primers). Primer selection was based on their ability to produce unique alleles and the presence of a high level of polymorphism.

TABLE 1

Sequences and conditions of SSR primers currently used in loblolly pine.

Primer ID	SEQUENCE (5'-3')	LABEL TAIL (F/R); E (end labeled)	$MgCl_2$ (mM)	Tm (° C.)	Size (bp)
PtTX 2146	F: CACGACGTTGTAAAAC GACCTGGGGATTTGGATT GGGTATTTG; SEQ ID NO: 1 R: ATATTTTCCTTGCCCC TTCCAGACA; SEQ ID NO: 2	F	2.5	59	200
PtTX 3034	F: CACGACGTTGTAAAAC GACTCAAAATGCAAAAG ACG; SEQ ID NO: 3 R: ATTAGGACTGGGGATG AT; SEQ ID NO: 4	F	1.5	55	225
PtTX 3049	F: GAAGTGATAATGGCAT AGCAAAAT; SEQ ID NO: 5 R: GCAGACCCGTGAAAGT AATAAACAT; SEQ ID NO: 6	R	3	55	330
PtTX 3105	F: TGTCGGTGGAGTTGGC AGTAGACT; SEQ ID NO: 7 R: GCCCAGCGTTTCCTG; SEQ ID NO: 8	E	2	59	280
PtTX 3116	F: CACGACGTTGTAAAAC GACCTCCCAAAGCCTAAA GAAT; SEQ ID NO: 9 R: CATACAAGGCCTTATC TTACAGAA; SEQ ID NO: 10	F	2.5	59	165

Microsatellite products were detected by M13 tailed primer (Oetting et al., 1995) or infra-red dye (IRD)-labeled primer. The amplification products were electrophoresed on 5.5% Long Ranger polyacrylamide gels using a LiCor 4200 automated sequencer (LiCor Inc., Lincoln, Nebr.). For each family, the female and male parents, as well as eight offspring were genotyped.

The observed parental genotypes and their expected offspring's genotypes at five studied SSR loci of each family are presented in Table 2.

TABLE 2

Parental genotypes and their expected offspring's genotypes at five different SSR loci of each family.

	Genotype					
Primer	Female	Male	Expected offspring genotype			
PtTX 2146	181/199	193/208	181/193	181/208	193/199	199/208
PtTX 3105	166/184	169/172	166/169	166/172	169/184	172/184
PtTX 3034	226/228	216/226	216/226	226/226	226/228	
PtTX 3049	301/303	301/311	301/301	301/303	301/311	
PtTX 3116	151/163	151/160	151/151	151/160	160/163	

In general, offspring genotypes segregated following expected simple Mendelian segregation (see Table 3, for offspring multi-locus genotypes).

TABLE 3

Parents and offspring genotypes at 5 different SSR loci for two loblolly pine full-sib families.

	Sample	PtTX 3034[a]		PtTX 3049[a]		PtTX 3116
ID	ID	Allele 1	Allele 2	Allele 1	Allele 2	Allele 1
Offspring	Q 7766	226	226	301	303	151

	PtTX 3116	PtTX 2146[a]		PtTX 3105	
ID	Allele 2	Allele 1	Allele 2	Allele 1	Allele 2
Offspring	151	181	193	169	184

[a]Allelic sizes have LiCor primer tails.

References:

Auckland, L., T. Bui, Y. Zhou, M. Shepherd and C. Williams. 2002. Conifer Microsatellite Handbook Corporate Press, Raleigh, N.C., USA.

Doyle, J. J. and J. L. Doyle. 1987. A rapid DNA isolation procedure for small quantities of fresh tissue. Phytochemical bulletin 19:11–15.

Oetting, W. S., H. K. Lee, D. J. Flanders, G. L. Wiesner, T. A. Sellers and R. A. King. 1995. Linkage analysis with multiplexed short tandem repeat polymorphisms using infrared florescence and M13 tailed primers. Genomics 30:450–458.

SEQUENCE LISTING

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<210> SEQ ID NO 1
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<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
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<213> ORGANISM: Artificial
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<220> FEATURE:
<223> OTHER INFORMATION: Oligonucleotide PtTX 3116 - R

<400> SEQUENCE: 10

catacaaggc cttatcttac agaa 24

We claim:

1. A new and distinct variety of loblolly pine tree named 'CF Q7766' substantially as described and illustrated.

* * * * *

FIG. 1

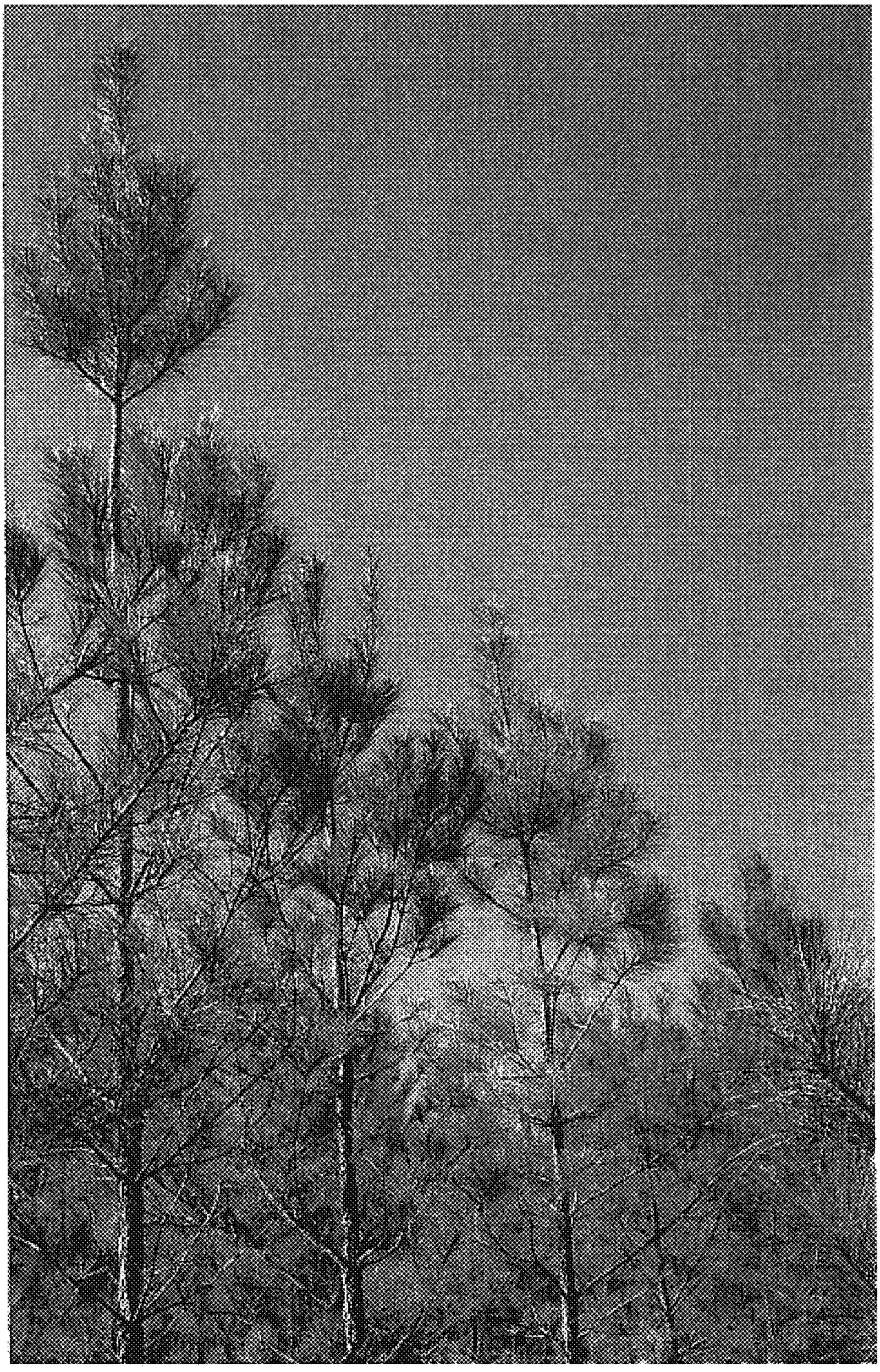

FIG. 2