



United States
Department of
Agriculture

soil
Conservation
Service

P.O. Box 2890
Washington, D.C.
20013

Curtis Copy

March 18, 1992

SUBJECT: ECS - Plant Releases from the Brooksville
Plant Materials Center

TO: Niles T. Glasgow, State Conservationist,
SCS, Gainesville, FL

Please find enclosed signed copies of all the original release
notices for 'Northpa' and 'Southpa' bitter panicum. We have
retained a reproduce copy of each release for our files.

James B. Newman

JAMES B. NEWMAN
Director
Ecological Sciences Division

Enclosures



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United States
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Soil
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Service

Federal Building, Room 248
401 Southeast First Avenue
Gainesville, FL 32601-6849

February 26, 1992

James B. Newman, Director
Ecological Sciences Division
WSDA, Soil Conservation Service
Washington, D. C. 20013

Dear Mr. Newman:

The enclosed document is for the release of 'NORTHPA' and 'SOUTHPA' bitter panicum, two plants released through the Plant Materials Center in Brooksville, Florida. Please note that the four (4) tabbed pages are for your signature. Please sign and return the entire document to me, and then it will be properly reproduced and distributed by my staff. A document containing original signatures will be reserved for you.

Your timely execution of this matter will be greatly appreciated.

Thank you very much.



T. Niles Glasgow
State Conservationist

Enclosure

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ECOLOGICAL SCIENCES AND TECHNOLOGY DIVISION
WASHINGTON, D.C.

NOTICE OF RELEASE OF 'NORTHPA' AND 'SOUTHPA' BITTER PANICUM

The United States Department of Agriculture, Soil Conservation Service announces the naming and release of 'Northpa' and 'Southpa' bitter panicum, *Panicum amarum* Ell. Identification was done by Dr. David Hall, Botanist, with the University of Florida.

Both bitter panicums were developed at the USDA Soil Conservation Service Plant Materials Center at Brooksville, Florida. From 1957 to 1980, the Plant Materials Center received and accessioned a total of 157 *Panicum amarum* and *P. amarulum* accessions from a very broad spectrum of locations within their range of adaptation.

'Northpa' and 'Southpa' were selected for their ease of establishment and their adaptation to coastal sand dune situations that exist in Florida and the other Gulf Coast states. Both cultivars have the ability to trap blowing sand and are thereby considered "dune builders" or "living

sandfences". The stems of the plant will stop sand as it is displaced by wind blowing as in the case of stormy weather conditions. Over a period of time this trapped sand will accumulate and form mounds which are referred to as sand dunes. As the sand dunes are being built the plants aerial stems that are covered will take root, thereby strengthening the old plant and giving rise to new ones. Both cultivars have the ability to resist being covered by sand whether its from blowing sand or from sand deposited by water.

Wind erosion protection, beach and sand dune stabilization and wildlife cover for birds are the primary reasons for the variety releases. A secondary reason for release is that other cultivars are not no3 available on the commercial market. Bitter panicum, despite the fact that it has to be vegetatively propagated, will fill the need for the species for use in these situations.

'Northpa', PI- 421957, origin Dare County, NC, was selected for more northern locations and is adapted further into the cooler climates thereof; 'Southpa', 9003324, from Palm Beach County, FL, came from and is adapted to more southern locations. The latter portion of each name "pa" (pronounced pay) is taken from the letters that are the abbreviations of

the genus and species names (i.e. 'p' for *Panicum* and 'a' for *amarum* = 'pa').

Initial evaluation data was first taken in 1977 on this species. It was not long in this process before it was realized that the species had problems with seed production. Various methods of vegetative propagation were tried. It was found that cuttings rooted in the greenhouse was the most successful and efficient means available. The success rate in the greenhouse is better than any other method. The use of auxins or growth hormones is strongly encouraged.

Panicum amarum, bitter panicum, occurs naturally in many locations in Florida. Several publications site the occurrence of this plant in all of the Gulf coastal states and all of the Atlantic coast states from Connecticut to Florida. There is great similarity between bitter panicum and coastal panic grass. Taxonomist are at times at odds with each other as to the most current classification of this species.

Breeder stock of 'Northpa' and 'Southpa' will be maintained by the USDA Soil Conservation Service's Plant Materials Center at Brooksville, Florida. Vegetative methods of

commercial production, which does not exclude micro propagation, will be used to sustain these cultivars.

James B. Newman
James Newman, Director
Ecological Science Division
USDA, Soil Conservation Service
Washington, D.C.

3/19/92
Date

T. Niles Glasgow
T. Niles Glasgow
State Conservationist
USDA, Soil Conservation Service
Gainesville, Florida

2/27/92
Date

PROPOSED RELEASE
of
NORTHPA and SOUTHPA
Panicum amarum
Bitter **panicum**
PI-421957 and SCS-9003324

I. ORIGIN

The field collections of these accessions of bitter panicum were as follows: NORTHPA, *Panicum amarum* was vegetatively collected February 12, 1972, by Dr. Steve Broomed, Clayton, North Carolina Agricultural Experiment Station. The accession was sent to the Brooksville Plant Materials Center (PMC) April 4, 1977. It was from the Northeast side of Roanoke Island at Wanchese, Dare County, North Carolina on a sand dune. SOUTHPA, *Panicum amarum* was also vegetatively collected July 14, 1977, by Robert E. Somer. It was collected from Palm Beach County, Florida, 0.75 miles south of Carlin Park at Highway A1A near the edge of the blacktop. The location is Section 5, Township 41, Range 43 in MLRA 155. Soils at the collection site were described as: Beach sand at an elevation of 15 feet above sea level. NORTHPA was evaluated under the number 12-6977 and later assigned PI-421957. SOUTHPA was first accessioned as 12-7037 and later assigned SCS-9003324. A PI Number has been requested but not yet assigned.

II. DEBCRIPTION

Panicum amarum, Ell. Bitter panicum is a coarse perennial with hairless glaucous clumps in large or small clumps or solitary from stout, creeping rhizomes. Erect culms 0.3-2 meters or more tall. Leaves firm, glaucous, usually glabrous except for the ligular hairs. Sheaths rounded. Ligule a ciliate membrane, about 0.5 mm long, the hairs 1.5-3mm long. Blades flat or folded, elongate, mostly 3-15 mm broad. Panicles dense, contracted, 10-35(-50)cm long. Panicle branches, branchlets and pedicels glabrous, the pedicels short and stout. Spikelets mostly 4.5-5 (-6.5) mm long, glabrous. Glumes acute, the glume one-half to two-thirds as long as the second, the second slightly exceeding the lower lemma, usually narrow and appearing somewhat beaked at apex. Lower floret staminate, with palea slightly shorter than lemma. Lemma of upper floret smooth and shiny, ovate or oblong. Chromosome number, $2n=36$.

Bitter panicum is a beach and dune stabilizing native species that can be used alone or in combination with other plants. It is a warm season perennial grass found growing on the coastal region from Connecticut to Georgia; Southern Mississippi and Texas. It has also been identified on the beaches along the coast of Florida. Literature has not shown that it will produce viable seed but it does propagate by rhizomes.

This rhizomatous perennial grass is native to frontal coastal sand dunes of the Gulf and Atlantic coasts. It is a major

component of the dune plant community along the Gulf and South Atlantic coast decreasing to a minor associate along the North Atlantic above Cape Hatteras, North Carolina. Spread is by rhizomes or aerial stems which readily root in sand at the nodes. Small quantities of seed appear to be produced but with highly variable quality. Greenhouse and field production is possible with rhizomes and with rooted and unrooted stem cuttings.

Northpa does not emerge as early as Southpa in the spring of the year at the Brooksville PMC location. Southpa is more erect in its growth habit than Northpa. Northpa has a sub-erect to slightly decumbent growth habit when compared to Southpa. Southpa will tend to be more open (less dense) allowing birds to use it for cover.

III. CONSERVATION USE

The principle conservation uses of bitter panicum are wind erosion protection, beach stabilization, sand dune stabilization, and wildlife cover (birds). The plant is salt tolerant, making it an excellent choice to use on beach/dune projects. These plants should be considered when selecting species to use in combination with crosswalks and snowfence. At this point there is no named variety of this species available in the commercial channels. This species will grow very well where seaoats are found naturally or planted. Bitter panicum can also be used where Marshhay cordgrass, (*Spartina patens*), beach sunflower, (*Helianthus debilis*) and various other beach/dune species are

located. The two cultivars have a growth habit and type that make them desirable because they will trap sand and serve as a windbreak plant. In the report "Construction and Stabilization of Coastal Foredunes with Vegetation: Padre Island, Texas" ¹ the following conclusions were made: "... bitter panicum, is stimulated by the accumulation of fresh sand continually blown inland from the shore. Windblown sand is trapped by exposed grass blades and eventually stabilized by the root and rhizome system." It goes on to say, "Growth is from primary shoots, lateral shoots (aerial nodes), or tillers (subterranean nodes). In a typical foredune habitat, drifting sand often covers part of the exposed culm, and the covered lateral shoots root at the nodes as do rhizomes or stolons. ...Schematic growth of a single-clum vegetative transplant of bitter panicum is shown in Figures 1 and 2. The clump will eventually expand vertically and horizontally in all directions by a continuation of the same process. At the perimeter are the laterally spreading tillers, while in the center of a clump are the more verticle mature primary culms. Greatest vigor occurs where blowing sand accumulates around the plant. The sand either mechanically or nutritionally stimulates the growth of new shoots and tillers which keep pace with the accumulation. If the sand supply is choked off as on the leeward parts of a foredune, the plants appear nutrient-deficient after several years."

IV. EVALUATIONS

Field collections were made throughout the southeast from 1972-1977. One hundred and fourteen were established and evaluated (originally there were 157 *P. amarum/amarulum* accessioned) in rod rows on a Kendrick fine sand from 1978-1981. Ten were selected for advanced evaluation based on vigor, density of foliage and rate of spread. Advanced evaluations were performed in 1982 and 1983 in replicated blocks. Little differences were noted on vigor, pest resistance, or rate of spread; but differences in rooting ability, seed production, and germination were exhibited. In the spring of 1983 rooted cuttings were established at the Kingsville, TX PMC; Coffeenville, MS PMC; Americus, GA PMC; Cape May, NJ PMC; and two field evaluation locations in Louisiana and one in Florida.

Data from advanced and field evaluations were reviewed with selection based on vigor, propagation success, and rate of spread. The following accessions were selected for field evaluation plantings along the Gulf and Atlantic coasts:

<u>Accession</u>	<u>Origin</u>
421909	Martin County, FL
421932	Lee County, FL
421969	Manatee County, FL
9003324	Palm Beach County, FL
421976	Kleberg County, TX
421957	Dare County, NC

In 1987 the decision was made that there was enough need for this species on the commercial market that release was essential. No cultivar was available commercially. In 1989 the accessions being evaluated were reduced to two. The two differed basically because of their areas of adaptation. Since neither would adequately cover the area of anticipated demand and usage alone, and the differences between the two were not of great significance, both plants were released. Identification of plant specimens was done by Dr. David Hall, Extension Botanist, University of Florida.

V. DISEASE AND INSECT PROBLEMS

During the time of evaluation at the Plant Materials Center at Brooksville no problems with disease or insects were noted.

VI. AREA OF ADAPTATION

Panicum amarum Ell. according to Frank W. Gould in the book "THE GRASSES OF TEXAS" says of the area of adaptation: "... General: On the Atlantic and Gulf coasts from Connecticut to Florida and

Texas, in the West Indies and on the eastern coast of Mexico."

Because of reclassifications, combinations, and other events the literature may not agree on the same general area of distribution or adaptation.

'Northpa' is adapted from New Jersey south to Florida and Texas, on the Atlantic and Gulf coasts. 'Southpa' is adapted along the Gulf coast from Florida to Texas and to Georgia along the Atlantic coast.

VII. PRODUCTION

Breeder material will be maintained by the USDA SCS Plant Materials Center at Brooksville, Florida. The production field at Brooksville is a Kendrick fine sand at about 120 feet above sea level. Any sandy-fertile, agricultural soil would be satisfactory for a production field. The PMC production field will be primarily used to maintain the propagation stock material since the main method of production will be rooting of cuttings in the greenhouse. By mid-March spring recovery should be enough to start taking propagules into the greenhouse.

Under normal conditions a 70% to 80% success rate of propagation is good. Row spacing and spacing of plants within the row should be based on the needs of the producer, with consideration for harvesting of the 'canes', cultivation, fertilization, and

separation of the individuals for weed control purposes. A broadcast application of 50 to 100 pounds per acre of 10-10-10 fertilizer, incorporated prior to planting, is recommended.

Potential growers or commercial suppliers are advised to seek materials from the Plant Materials Center for the purpose of establishing a source of cutting stock for greenhouse propagation.

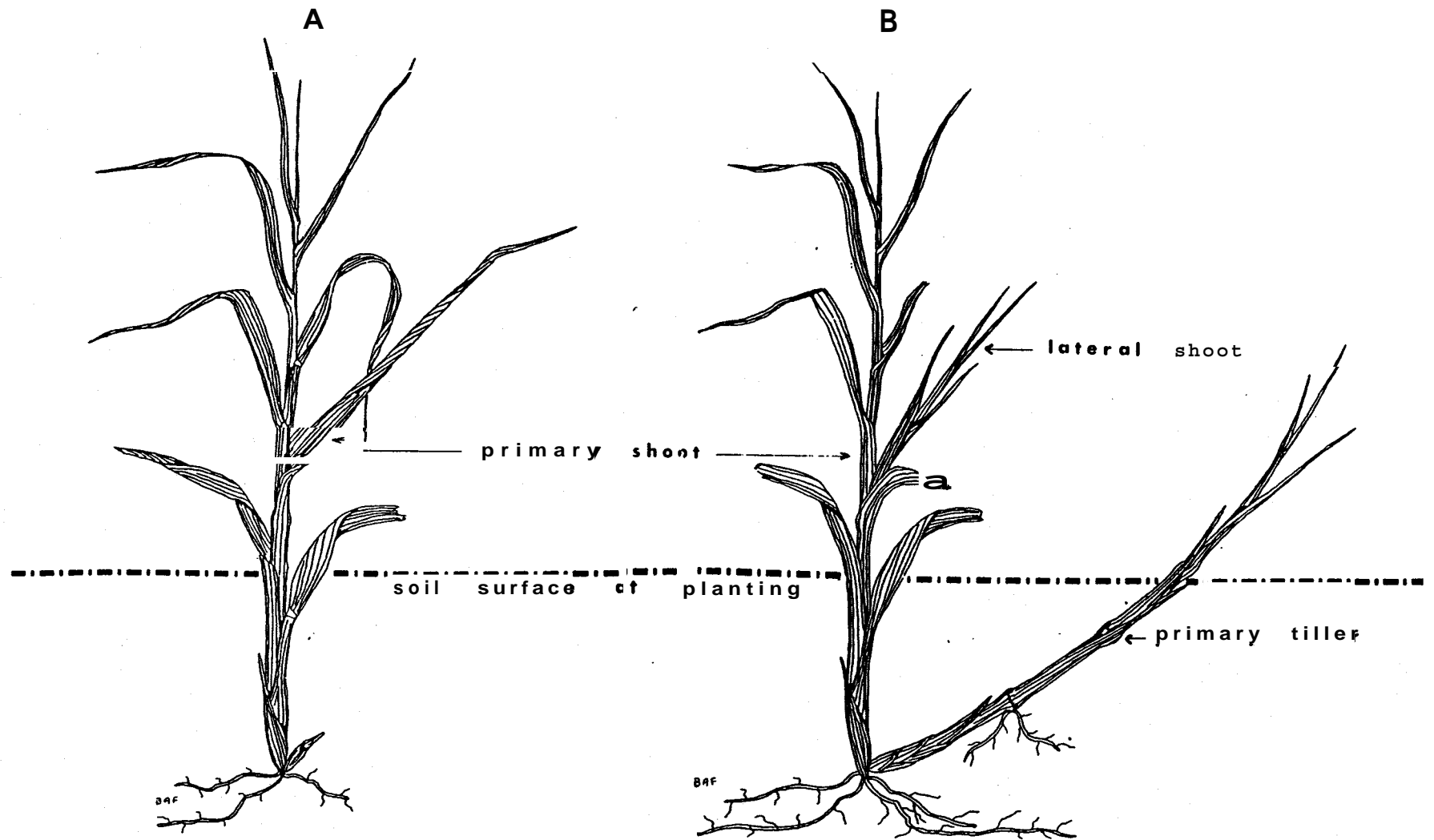
Literature Cited

¹ Dahl, Bill E, Bruce A. Fall, Alan Lohse, and S.G. Appan, Construction and Stabilization of Coastal Foredunes with Vegetation: Padre Island, Texas. Miscellaneous Paper No. 9-75, US Army, Corps of Engineers, Coastal Engineering Research Center, Kingman Building, Fort Belvoir, VA.

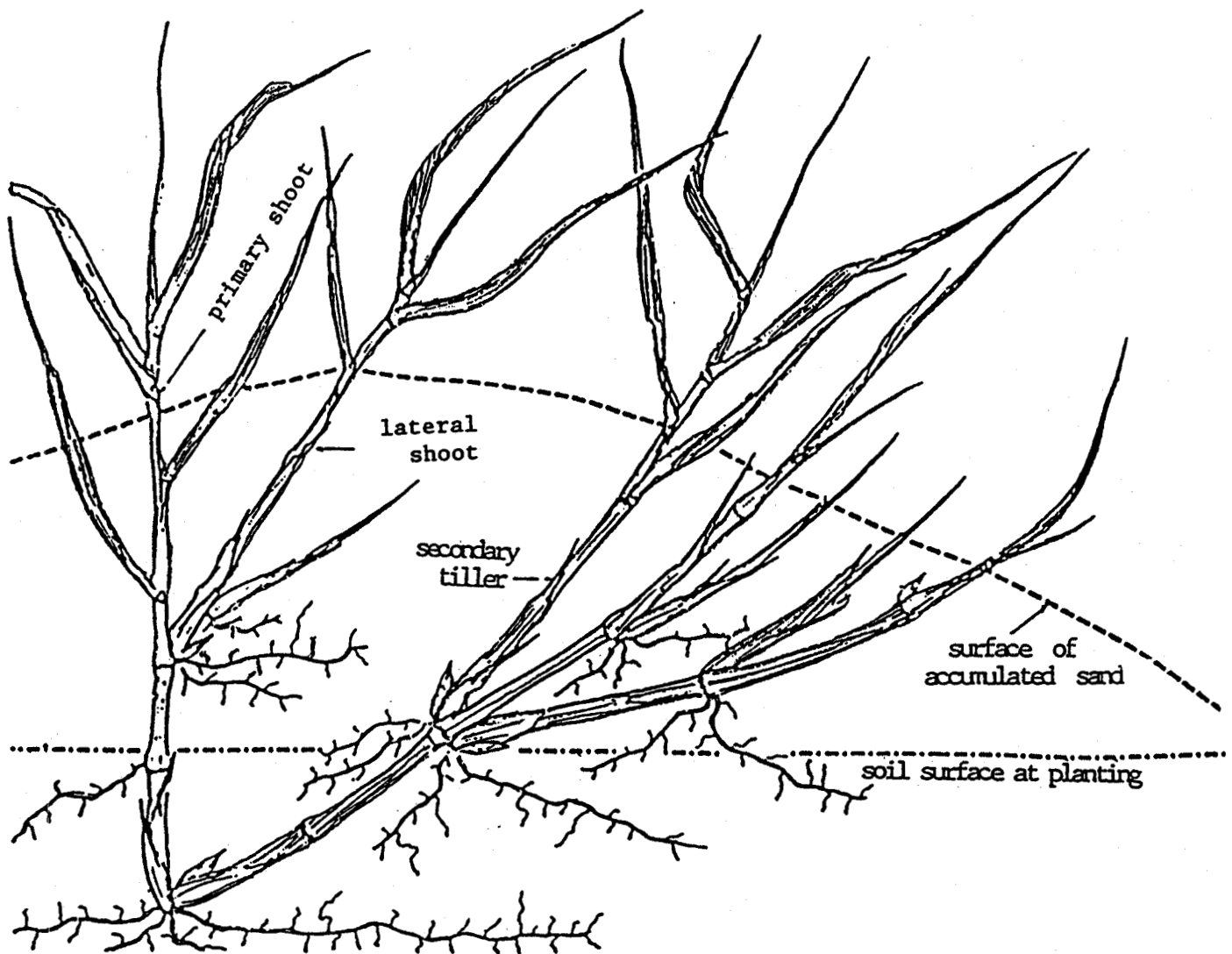
APPENDICES

- Figure 1 Growth Habit of Bitter Panicum
- Figure 2 Bitter Panicum Growth at End of First Summer
- Appendix 1 Project 12A031C - Advanced Evaluation of Bitter Panicum
- Appendix 2 Project 12A031C - Advanced Evaluation of Bitter Panicum
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- Appendix 7 Project 12A031C - Advanced Evaluation of Bitter Panicum

Figure 1



Growth habit of bitter panicum. Vegetative culm (A) soon after transplanting; spring growth (B) several months after planting. Growth is from a lateral shoot and a primary tiller.



Bitter panicum growth at end of first summer. Lateral growth is shown in one direction only. Initial transplant has grown vertically and horizontally, accompanied by sand accumulation. Lateral shoot is buried, has rooted, and has formed a tiller and new buds. Primary tiller has given rise to secondary tillers which are in turn forming new tillers at the buried nodes.

Figure 2

APPENDIX 1

PROJECT 12A031C - ADVANCED EVALUATION OF BITTER PANICUM

(Panicum amarum)

DIRECT VEGETATIVE ESTABLISHMENT TRIAL¹

<u>ACCESSION</u>	<u>PLANTS PER 12 FOOT UNCUT STEM - HORIZONTAL</u>	<u>PLANTS PER 12 FOOT CUT STEMS - VERTICAL</u>
421909	5.0A	8.7A
421932	5.3AB	4.3B
421957	6.7A	6.3AB
421959	3.7B	5.7B
421969	5.3AB	4.0B
421976	2.0B	3.3B
T03321	7.0A	7.3A
T03323	5.0AB	5.0B
T03324	5.0A	7.0A
AVERAGE	<u>4.5</u>	<u>5.2</u>

¹ Established on December 2, 1982 in Kendrick fine sand at the Brooksville Plant Materials Center. Data is the most recent survival count on August 8, 1984 and is the average of three replications.

Data with different letters behind it is significantly different at the 95% level of confidence in an analysis of variance.

APPENDIX 2

PROJECT 12A031C - ADVANCED EVALUATION OF BITTER PANICUM

(Panicum amarum)

COFFEEVILLE, MISSISSIPPI PLANT MATERIALS CENTER¹

CRITERIA	ACCESSION		
	<u>421957</u>	<u>421959</u>	<u>421796</u>
Survival %	100	100	100
Vigor ²	1	1	3
Stems Per Plant	70	79	109
Basal Spread (cm)	40	40	30
Canopy Width (cm)	260	300	220
Height (cm)	90	95	55

AT TRANSPLANT FROM AMERICUS, GEORGIA PMC - 5/24/84³

ACCESSION	HEIGHT	HABIT	TRANSPLANTS	REMARKS ⁴
421957	24"	Erect	500	10-25 shoots per mother plant
421969	24"	Erect	200	Deep roots 8-12"
T03324	18"	Prostrate	100	
421976	12"	Prostrate	70	
421932	12"	Prostrate	45	
421909	12"	Prostrate	50	Poor roots, 5-6 shoots per mother plant

¹ Established in April, 1983 on a silty clay loam

² Rated 1-9; 1 = Excellent, 9 = Very Poor

³ Established in March, 1983 on an Orangeburg silty clay loam

⁴ All root depths 4-6" except 421969

APPENDIX 3

PROJECT 12A031C - ADVANCED EVALUATION OF BITTER PANICUM

(Panicum amarum)

MANTEO, DARE COUNTY, NORTH CAROLINA¹

<u>ACCESSION</u>	<u>SURVIVAL % (August)</u>	<u>BASAL SPREAD'</u>	<u>VIGOR² (August)</u>
421909	70B	3	5.0
421932	92A	3	3.7
421957	88A	3	1.7
421969	58B	3	4.0
421976	0	0	0
T03324	72B	3	2.3
	<hr/>	<hr/>	<hr/>
AVERAGE	76	3	3.3

¹ Established in April, 1984 on a Newhan fine sand

² Rated 1-9; 1 = Excellent, 9 = Very Poor

Data with different letters behind it is significantly different at the 95% level of confidence in analysis of variance.

APPENDIX 4

PROJECT 12A031C - ADVANCED EVALUATION OF BITTER PANICUM (*Panicum amarum*)

1

SANIBEL ISLAND CAUSEWAY, LEE COUNTY, FLORIDA/

ACCESSION	PERCENT SURVIVAL		HEAT TOLERANCE/	RESISTANCE/		VIGOR/	STEMS PER PLANT	BASAL SPREAD (cm)	CANOPY WIDTH (cm)	HEIGHT (cm)	
	AUG	OCT		DISEASE	INSECT					FOLIAGE	SEEDHEAD
421909	47B	45	4.7	3.7	3.3	5.0AB	10.7A	40.0AB	116.7AB	51.7A	86.7A
421932	67AB	62	3.3	3.3	2.3	5.0A	10.0AB	46.7A	153.3A	55.0A	96.7A
421957	73AB	60	5.7	4.3	1.7	6.7B	5.0B	26.7B	75.0C	46.7A	61.7A
421969	58AB	54	3.7	3.0	3.3	4.7AB	9.7A	31.0AB	163.3A	58.3A	88.3A
421976	85A	80	4.7	3.0	3.0	6.0B	23.3A	26.7B	83.3BC	30.0B	31.7B
T03324	53B	47	3.3	3.0	1.7	4.7A	10.7A	38.0AB	150.0AB	58.3A	85.0A
AVERAGE	63	58	4.2	3.4	2.6	5.3	11.5	34.9	123.6	50.0	75.0

1

/ Established in June, 1984 on dredge spoil, three replications per accession.

2

/ Rated 1 - 9; 1 = Excellent, 9 = Very Poor

Data with different letters behind it is significantly different at the 95% level of confidence in an analysis of variance.

APPENDIX 5

PROJECT 12A031C - ADVANCED EVALUATION OF BITTER PANICUM (*Panicum amarum*)

TYBEE ISLAND, CHATHAM COUNTY, GEORGIA¹

ACCES- SION	%	VIGOR ²			TOLERANCE ²		RESIST. ²		ABUNDANCE ²		RHIZOME SPREAD ²	STEM COUNT	BASAL CANOPY SPREAD WIDTH		FOLIAGE (cm)		SEED- HEAD HGT (cm)
		SURV.	MAY	AUG	OCT	DROUGHT	HEAT	DISEASE	INSECT	AUG			OCT	(cm)	(cm)	AUG	
421909	53B	3.7AB	3.7AB	3.7	3.7	3.3	3.0	3.0	3.3	3.7	4.0B	19	105	160	25B	82	130A
421932	32C	4.0B	3.7AB	3.7	3.3	3.3	3.3	3.0	3.3	3.3	4.0B	31	130	148	23B	69	117AB
421969	24C	4.7BC	4.0B	4.0	3.7	3.3	3.0	3.0	4.0	4.7	4.0B	23	76	132	23B	81	147A
T03324	75A*	4.7BC	3.5AB*3.5*	3.0*	3.0*	3.0	3.0	3.0	3.7	3.7	4.3B	18	85	133	35B	81	135A
421976	29C	5.0C	4.3B	3.7	3.7	3.3	3.3	3.0	3.7	2.7	4.0B	35	94	109	23B	31	X
421957	81A	3.0A	2.7A	3.3	3.0	3.0	3.0	3.0	3.7	3.3	3.0A	28	85	150	43A	75	91B
AVERAGE	<u>49</u>	<u>4.2</u>	<u>3.7</u>	<u>3.7</u>	<u>3.4</u>	<u>3.2</u>	<u>3.1</u>	<u>3.0</u>	<u>3.6</u>	<u>3.6</u>	<u>3.8</u>	<u>26</u>	<u>95.8</u>	<u>139</u>	<u>29</u>	<u>73</u>	<u>124</u>

¹Established in April, 1984 on a sand dune

²Rated 1-9; 1 = Excellent, 9 = Very Poor

*Two of three replications evaluated, other was trampled to the extent that it affected these criteria for T03324. Data with different letters behind it is significantly different at the 95% level of confidence in an analysis of variance.

APPENDIX 6

PROJECT 12A031C - BITTER PANICUM (Panicum amarum)

ADVANCED EVALUATION PLANTING

KINGSVILLE, TEXAS PLANT MATERIALS CENTER¹

1985 DATA

<u>ACCESSION</u>	<u>BASAL WIDTH(cm)</u>	<u>CANOPY WIDTH(cm)</u>	<u>HEIGHT(cm)</u>	<u>VIGOR²</u>	<u>LEAF ABUNDANCE²</u>	<u>RANKING FOR USE</u>
T03324	90	160	100	3	1	1
421932	60	110	125	3	1	2
421909	120	160	105	4	3	3
421969	70	120	110	4	1	4
421957	55	130	85	4	5	5
	—	—	—	—	—	—
AVERAGE	79	136	105	3.6	2.2	

¹ Established March 18, 1992, evaluated November 15, 1985.
Evaluators confirm these five accessions best of original advanced evaluation selections.

² Rated 1 to 9; 1 = excellent, 9 = very poor

APPENDIX 7

PROJECT 12A031C - ADVANCED EVALUATION OF BITTER PANICUM (Panicum amarum)¹VERTICAL STEM CUTTINGS - UNROOTED - 1985

ACCESSION	PLANTS PER 15' ROW	AIR DRY WEIGHT ²		TOLERANCE ³		RESISTANCE ¹		VIGOR ³	CANOPY WIDTH(cm)	FOLIAGE HEIGHT(cm)	SEED STALK HEIGHT(cm)
		PER 15' ROW	PER PLANT	DROUGHT	HEAT	DISEASE	INSECT				
421909	8	3.5	.29	3	4	5	4	5-5-5-5	155	150	200
421932	6	2.2	.39	4	4	5	5	5-5-5-5	180	125	180
421957	8	2.5	.31	4	4	6	4	6-6-6-6	270'	95	140
421969	4	1.6	.40	4	4	5	4	5-5-5-6	200	130	180
T03324	6	4.6	.76	4	4	5	4	5-4-4-5	175	150	185
AVERAGE	<u>6</u>	<u>2.9</u>	<u>.43</u>	<u>4</u>	<u>4</u>	<u>5</u>	<u>4</u>	<u>5-5-5-5</u>	<u>196</u>	<u>130</u>	<u>177</u>

BURIED STEMS - UNROOTED - 1985

ACCESSION	PLANTS PER 15' ROW	AIR DRY WEIGHT ²		TOLERANCE ³		RESISTANCE ³		VIGOR ³	CANOPY WIDTH(cm)	FOLIAGE HEIGHT(cm)	SEED STALK HEIGHT(cm)
		PER 15' ROW	PER PLANT	DROUGHT	BEAT	DISEASE	INSECT				
421909	10	3.6	.36	3	4	5	4	5-5-5-5	160	145	200
421932	13	5.0	.38	4	4'	5	5	5-5-5-5	180	130	185
421957	11	5.3	.48	4	4	6	4	6-6-6-6	370	97	105
421969	11	5.6	.51	5	4	5	4	5-5-5-5	210	130	175
T03324	11	4.6	.41	4	4	5	4	5-5-4-5	180	155	187
AVERAGE	<u>11</u>	<u>4.8</u>	<u>.43</u>	<u>4</u>	<u>4</u>	<u>5</u>	<u>4</u>	<u>5-5-5-5</u>	<u>220</u>	<u>131</u>	<u>171</u>

¹Established November 19, 1984 on Kendrick fine sand in PMC field 112; 3 replications per accession per planting method. Vertical stem cuttings planted 15 per 15 foot row. Buried stems (variable lengths to give total of 15 foot of stem) placed in dug row and buried 6 inches deep. Nodes averaged about 3 to 5 per foot of stem.

²Materials harvested March, 1986; field air-dry, in pounds.

³Rated 1 to 9; 1 = excellent, 9 = very poor. Vigor Rating dates, respectively: 4/18/86; 7/23/86; 9/19/86; 10/16/86