A. NOTICE OF NAMING AND RELEASE
OF
'TIMP' UTAH SWEETVETCH (HEDYSARUM BOREALE Nutt.)

FOR

SOIL IMPROVEMENT AND EARLY SPRING FORAGE FOR BOTH WILDLIFE AND LIVESTOCK

BY THE:
UPPER COLORADO ENVIRONMENTAL PLANT CENTER; Meeker, Colorado
and the
UTAH DIVISION OF WILDLIFE RESOURCES; Ephraim, Utah
and the
COLORADO AGRICULTURAL EXPERIMENT STATION-COLORADO STATE UNIVERSITY; Fort Collins, Colorado
and the
UTAH AGRICULTURAL EXPERIMENT STATION-UTAH STATE UNIVERSITY; Logan, Utah
and the
UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE-INTERMOUNTAIN RESEARCH STATION; Ogden, Utah
AGRICULTURAL RESEARCH SERVICE-FORAGE AND RANGE RESEARCH LABORATORY; Logan, Utah
and the
SOIL CONSERVATION SERVICE-ECOLOGICAL SCIENCES DIVISION; Washington, DC

The groups listed above announce the naming and release of 'TIMP' Utah sweetvetch (Hedysarum boreale) for commercial production and marketing of seed and plants based on results of coordinated and independent study of native Utah sweetvetch collections by the sponsors.

'TIMP' Utah sweetvetch is a seed-propagated cultivar recommended for use on rangelands, upland wildlife habitat improvements, and critical areas within its historically recognized natural range. This area is generally described as the Intermountain Region of Utah, Colorado, Wyoming and Idaho (Major Land Resource Areas 47-Wasatch/Uinta Mountains, 34-Central desertic basin, mountains, and plateaus. 48A-Southern Rocky Mountains).

Utah sweetvetch grows in areas with 12 to 18 inches of annual precipitation preferring well-drained, basic sites. It is found on soils ranging from sands to heavy clay with wide pH variations.

'TIMP' Utah sweetvetch is a cool-season perennial, herbaceous legume. This variety is upright (1-2 ft.), multiple branched, leafy, with abundant attractive pink flowers producing long lomented seedpods (chainpod) forming in clusters on multiple seed stalks. Once established it is persistent, relatively long lived, more tolerant to other

species than competitive i.e. established acceptable stands under dense Russian thistle.

The foliage of Utah sweetvetch is palatable to big game and livestock. 'Timp' produces limited basal green foliage during winter. 'Timp' provides best forage in early spring to mid summer.

'Timp' has a long tap root. Through breeding and selection it has enhanced nitrogen fixing capability. A specific commercial inoculum is available to improve chances for nodulation and nitrogen fixation. 'Timp' when properly treated with commercial Rhizobium and established will improve soil nutrients, complementing diversity and biomass production of companion species. It is not a strongly competitive species at any stage of its life cycle.

'Timp' is highly susceptible to browsing/grazing damage during establishment because of its desirability.

ORIGIN

The genetic material originated from a site at the base of the Wasatch Mountains and east of Orem, Utah Co., Utah and 0.5 mile north of the mouth of Provo Canyon. The collection site ranges from 4800 to 5200 feet in elevation and has an annual precipitation of 14 to 16 inches. Soils at the site are well-drained, stony loam. Associated native vegetation consists of scattered Gambels oak and cliff rose, mountain big sagebrush, bluebunch wheatgrass, needle and thread and arrowleaf balsamroot.

Fifty per cent of the seed in 'Timp' came directly from this site (9040975).

The other 50 per cent came from plants grown from seed originating from the Orem site. However, these plants were grown and individuals selected based on two important traits, seed production and dinitrogen fixation. This select group of plants was considered improved and unified as 9024375 (Cuany Documentation attached). 9024375 was increased in a separate block. Seed produced was blended at the 50 per cent level with 9040975.

The breeders block for 'Timp' was established using 50 per cent 9040975 and 50 per cent 9024375. The progeny called 'Timp' is numbered T9024808. (A Plant Introductory Number will be assigned).

There are no released varieties of Utah sweetvetch for comparison.

DESCRIPTION

Multiple stems, 1 to 2 feet tall, emerging from a woody crown. Leaves alternate, odd-pinnate, 11 to 31 elliptic leaflets, glanddotted and highly variable in size, shape, and hairiness. Inflorescence an elongated, loosely arranged raceme with few to several showy pink flowers. Blooms late June, continuing through the summer season. Fruit matures into a flattened, constricted, chainlike pod.

ADAPTATION

'Timp' Utah sweetvetch is best adapted to well-drained rocky, gravelly, sand clay loam soils. It has proven acceptable performance where the annual precipitation ranges from 12 to 18 inches.

PERFORMANCE

Extensive initial evaluation trials, seed production trials, seed processing/conditioning trials, germination trials, laboratory trials, and field trials across the Upper Colorado Region have been conducted over the last 20 years on this species by the releasing agencies. Over 100 sources of sweetvetch (Hedysarum), representing both native and introduced species, have been compared in this evaluation/selection process.

'Timp' was selected based on its seedling vigor, site adaptability, persistence, seed production, dinitrogen fixation, and establishability.

CLASSES OF MATERIALS AVAILABLE

Breeder, Foundation, Registered, and Certified Classes of seed will be recognized. Criteria for all classes of seed will be included in the Utah and Colorado Seed Certification Standards.

MATERIAL DISTRIBUTION

The Upper Colorado Environmental Plant Center, Meeker, Colorado, 81641, will maintain 1).9024375 a component of the Breeders block, 2).the Breeders block (a 50:50 combination of 9024375 and 9040975), and 3). 'TIMP' (9024808) Foundation seed supplies. Distribution of Foundation seed from requests by commercial growers will be received by Cooperating Agencies and coordinated by the State Crop Improvement Association.

The Colorado Varietal Release Committee reviewed 'Timp' Utah sweetvetch January 19, 1994 and recommend it for release to commercial growers and users.

Approval Signatures:

_____, Date: 4/20/94
Dr. Charles Laughlin, Director
Colorado Agricultural Experiment Station
Fort Collins, Colorado

_____, Date: 5-10-94
Dr. H. Paul Rasmussen, Director
Utah Agricultural Experiment Station
Logan, Utah

_____, Date: 3/1/94
Duane L. Johnson, State Conservationist
USDA Soil Conservation Service
Lakewood, Colorado

John E Beckwith for, Date: 7/7/94
Norman W. Priest, Acting State Conservationist
USDA Soil Conservation Service
Salt Lake City, Utah

_____, Date: JUN 09 1994
Administrator,
for Agricultural Research Service
U. S. Department of Agriculture

_____, Date: 7/11/94
for Denver P. Burns, Acting, Station Director
USDA Forest Service, Intermountain Research Station
Ogden, Utah

_____, Date: 8 July 1994
Dr. E. Durant McArthur, Project Leader
USDA Forest Service, Shrub Sciences Laboratory
Provo, Utah

_____, Date: 7 JUN 94
Robert G. Valentine, Director
Utah State Division of Wildlife Resources
Salt Lake City, Utah

_____, Date: 7/21/94
Scott Robertson, President/Administrative Board
Upper Colorado Environmental Plant Center
Meeker, Colorado

_____, Date: _____
Peter Smith, Director
USDA Soil Conseration Service, Ecological Sciences Div.
Washington, DC

B. ORIGIN AND BREEDING HISTORY OF THE VARIETY

The genetic material originated from a site at the base of the Wasatch Mountains east of Orem, Utah Co., Utah and 0.5 mile north of the mouth of Provo Canyon. The collection site ranges from 4800 to 5200 feet in elevation and has an annual precipitation of 14 to 16 inches. Soils at the site are well-drained stony loam.

Fifty per cent of the Breeders seed for 'Timp' comes directly from the Orem site and is numbered 9040975. The other 50 per cent came from plants selected through a single-plant selection process conducted by Dr. Robin Cuany and numbered 9024375.

History of Utah Sweetvetch Strain 9024375

[Updated January 1994 by R.L. Cuany, N. Oleski and G. Thor.]

The origin of the strain 9024375 of Utah sweetvetch (Hedysarum boreale Nutt.). is by two stages of single-plant selection from a commercial seed lot obtained in 1976 from Stewart and Sons, Ephraim, UT. The selection was first for capacity to produce seed, measured in the years 1978-81 on plants spaced 30" apart in the nursery. Per-plant yields of cleaned seed ranged from 0 to 33 g among about 102 individuals, but there was a considerable fluctuation from year to year, some plants showing a distinct biennial tendency to bear a lot of seed followed by a little, or vice-versa. Average seed yield of plants in the nursery was 8.6, 5.1, and 7.8 g in 1979, 1980, and 1981 (there was flowering but no seed set in 1978, even though the nursery was established in 1977). Average yield of 14 selected plants (Table 1) was 23.0 g (range 10.2 - 33.1) and their 100-seed weight ranged from 0.68 to 1.33 g. In addition to high average yield per plant over three years some attention was paid to greater consistency of production.

Thirteen of these open-pollinated progenies (except R-5-7), plus three best-yielding other progenies of the same source material in another nursery, were subjected to seedling growth test and nitrogen fixation test in the greenhouse, as described hereafter (Oleski, Cuany, and Thor, 1982).

Seeds were scarified, germinated in the laboratory and transplanted after 3 days to clay pots containing Fort Collins clay loam soil mixed 1:1 with sand, in four replications. Seedlings were inoculated at transplanting by dusting with peat-based inoculum (Hedysarum Spec 2, from Nitragin Co.). Greenhouse temperatures were maintained at 24/15°C day/night and two 500 watt lights were on from 6:00 a.m. to 8:00 p.m. After three weeks of growth, seedlings were thinned to five per pot and allowed to grow to eight

weeks, at which time the acetylene reduction assay was employed on the seedlings from each pot after shaking off loose soil. After the incubation in 10% acetylene atmosphere, gas samples were extracted for gas chromatography. Seedlings were separated into nodules, roots, and shoots for obtaining dry weights.

No significant differences were observed between progenies for acetylene reduction to ethylene, expressed as umols g^{-1} nodule h^{-1}, called specific nodule activity (SNA) which is a measure of the capacity to fix dinitrogen. Since rates apparently varied from 14 to 78 umols, it was thought worthwhile to exert mild selection toward higher SNA rates. On the basis of ethylene produced per seedling rather than per gram of nodule in one hour, we selected 12 families as shown in Table 2, paying some attention also to shoot and root dry weights, which were almost significantly different among families ($p<.08$ and .15, respectfully). Shoot weight was strongly correlated with nodule weight ($r=0.85$), root weight (0.84) and acetylene reduction per plant (0.67). Nodule weight was also correlated with root weight ($r=0.80$) and acetylene reduction per plant (0.68), which in turn was correlated, though less strongly ($r=0.59$), to SNA per gram.

From results of this test, we chose 12 parents to represent the best of the group and used 12 progeny plants from each parent to make up recombination blocks of similar sets (half-sib progenies) in Meeker, Fruita, and Fort Collins. The set of 144 plants in Meeker is the breeders'. seed block of strain 9024375 being multiplied at the Upper Colorado Environmental Plant Center. Although we have data on subsequent seed production and forage vigor of the 12 families at Fort Collins and at Meeker, no further reduction in the broadness of the synthetic was made. [However, a further cycle of selection within 9024375 was made by Boukheloua (1990) and Cuany (unpublished) for seedling vigor in a zero-mineral-N greenhouse experiment whose best plants (300 out of 3000) were then selected in the field for vigor and seed production. The second cycle has not been further multiplied or tested since the polycrossing of the final 50 plants.]

In view of the amount of selection involved, we regard the strain 9024375 as a selection out of, and not the same as the original Stewart's commercial seed. The selection was done by Colorado State University agronomists Cuany, Zemetra, Oleski, and Thor, and the multiplication by the UCEPC/SCS. Testing is also under UCEPC/SCS auspices, and has shown the value of blending 9024375 into the Orem-Bench based proposed cultivar 'Timp'.

The progeny from the blend is called 'Timp' and numbered 9024808. This product has been submitted for a Plant Introductory Number.

Table 1. Plants showing above-average seed yield; Hedysarum at Fort Collins

Plant	Seed yield (g) per plant			
	79[1]	80[2]	81[3]	82
R-1-10	6.3	10.3	+ 12.7	
R-1-11		4.0	++33.1	
R-1-17	+		++23.9	
R-2-2	+	8.7	++29.7	
R-2-4	8.0	5.7	++29.1	
R-3-2	5.0	3.1	+ 12.8	
R-3-3		11.3	+ 10.2	
R-3-16	+		++22.7	
R-4-7		20.0	++25.7	
R-4-11	9.5	33.0	+ 19.6	
R-5-7	6.4	14.8	++32.7	
R-5-10	+	10.6	+ 13.1	
R-5-12	12.4	5.0	++32.9	
R-6-1	15.6	4.7	++23.5	
S-3-11	-	-	7.0[4]	20
S-5-1	-	-	6.2	15
S-7-1	-	-	6.6	16

[1] In 79, only 11 plants out of 102 had enough seed to make a reasonable harvest, those marked - had less than those weighed.

[2] In 80, mean yield of 57 plants harvested was 5.13g, but some excelled.

[3] In 81, mean of 77 plants harvested was 7.8g; over 10g marked. All plants in this table had good yields at least 2 years out of 3.

[4] Only 46 out of 192 plants had enough seed to be worth harvest at Stroh Farm in 81, and their mean yield was 1.43g, so only the 3 highest yielders, as shown, were in the N test.

Table 2. Seedling assay 1982 of Sweetvetch for acetylene reduction and selection of twelve open-pollinated families on which T-9024375 is based.

Family Code	Progeny	SNA Μmols C_2H_4 g^{-1} nodule hr^{-1}	Nodule D.Wt/ Plant	Root D.Wt/ Plant	Shoot D.Wt/ Plant	mg Nodule g^{-1} root	100-Seed Wt	Seed Yield rating 1985
			mg	mg	mg		g	
-	R-1-10	47.5	3.2	42	61	76	0.68	-
1	R-1-11	34.6	4.6	75	81	60	0.85	2.04
2	R-1-17	42.2	3.9	58	83	63	0.85	1.25
3	R-2-2	73.4	1.8	33	48	53	0.88	1.80
-	R-2-4	42.1	2.7	49	61	57	0.95	-
4	R-3-2	49.0	3.8	41	52	95	1.06	2.02
5	R-3-3	41.1	2.7	68	63	52	1.13	1.98
-	R-3-16	14.4	4.3	33	57	130	1.09	-
6	R-4-7	38.6	4.0	44	70	98	0.92	1.80
-	R-4-11	65.4	2.3	34	67	70	0.85	-
7	R-5-7*	-	-	-	-	-	1.04	2.09
-	R-5-10	46.5	3.2	31	57	118	0.91	-
8	R-5-12	71.0	3.6	44	72	84	1.02	1.95
9	R-6-1	53.8	4.4	50	98	90	1.33	2.08
10	S-3-11	59.9	7.2	100	134	71	1.24	1.50
11	S-5-1	60.3	3.2	49	89	68	1.26	1.38
12	S-7-1	51.4	4.7	76	85	64	1.03	1.86
-	ISS	78.3	2.0	30	37	67	0.74	-
	Mean	51.1	3.6	50	71	77	0.99	1.81
	S.E.	13.6	1.3	16	17	-	0.09	-

* Added 1 family not tested in SNA/nodule assay, because good seed yield.
† Rated on a 0-5 scale from 215 live plants out of 241 planted. Family mean.

C. BOTANICAL DESCRIPTION OF VARIETY

Cool season, herbaceous, perennial, leguminous forb.

Stems single to several from a woody crown, 1 to 2 feet tall.

Leaves alternate: odd-pinate, with 11 to 31 elliptic leaflets, gland-dotted and highly variable in size, shape, and hairiness; broader below and narrower above, with narrow, pointed stipules.

Inflorescence an elongated, loosely arranged raceme with few to several showy pink, or purple flowers; having a hairy 5 parted calyx and typical pealike banner, wing, and keel petals; maturing into a flattened, constricted, and reticulate several sectioned loment-type pod, each section containing one brown to ebony, kidney shaped seed (Harrington).

The seed unit is 2 to 3mm. long, 2 to 3mm. wide and 0.75mm thick. There are about 60,000 seeds per pound of 'Timp' from crops produced in cultivated fields. Seed counts representing both wild and cultivated populations are documented to range from 37,000 to 100,000 seeds per pound. Seed weights increased 17 per cent under test production environments compared to wild conditions. This supports the value of getting seed counts on each lot in order to reduce costs for overseeding, or poor stands because of too few seeds.

Full bloom occurs by mid June with seed maturity and harvest occurring from mid to late July.

Seed quality production at the Meeker UCEPC has ranged from 87 to 94 per cent germination with a 99 per cent purity.

D. EVIDENCE - BIBLIOGRAPHY

'Timp' is the first released variety of Utah sweetvetch. Colorado and Utah scientists recognized this as an important native legume to the Intermountain West.

Evidence of performance deals entirely with the two individual components of the blend, Orem Bench source and selection T24375 and their relative performance compared to many regional sources. The decision to blend these two materials for the released product was made at a coordination meeting April 28, 1989 with U.S. Forest Service, Utah Division of Wildlife Resources, Agricultural ~~Resource~~ Research Service, Soil Conservation Service, and Upper Colorado Environmental Plant Center (UCEPC).

Utah Division of Wildlife Resources (1991 correspondence) conducted field trials of 24 accessions over three decades, from which supportive data for successful use of the product has been developed.

Forest Service Shrub Sciences Laboratory has been involved in the historic work on the Orem Bench source of Utah sweetvetch primarily in Utah and Idaho.

Collections and trials have been conducted over a 29 year period in Utah, Colorado, Wyoming and Idaho. The genetic material in this released product has been a component of most trials conducted within the Great Basin and the Upper Colorado Region.

The Agricultural Research Service, Logan, Utah has learned and documented through extensive laboratory and field trials the value of Utah sweetvetch. Much of these data relate to the Orem Bench source of Utah sweetvetch.

Dr. Robin Cuany, Dept. of Agronomy upgraded the Orem Bench source by two stages of single-plant selection, first for seed production, secondly for seedling growth and third for nitrogen fixation. Twelve parents were selected to represent the best of the group and 12 progeny plants of each parent were used to make up the (breeders) recombination block of T24375. He views this strain a selection out of, and not the same as the original Orem Bench source.

The UCEPC began Utah sweetvetch collections of the region and worldwide sweetvetch introductions in 1975. The UCEPC has conducted multiple trials from initial screenings, field trials, to seed production/conditioning for the last 18 years. Over fifty collections were evaluated in projects between 1976 and 1990.

Much of the UCEPC documentation supports knowledge learned about the technology required to utilize and commercially produce and condition this unique product.

Three concerns relative to commercial seed production have been identified. The first and most significant is the impact of a seedborn insect that can damage 50 per cent of the seed crop. The insect is difficult to control. The second is the difficulty of removing damaged seed. Insect filled seed is the same size as healthy seed. Cooperative studies with Dr. Bob Hammon CSU Entomologist have identified the pupae (a seed weevil) and tested control techniques. A third problem is the loments breaking apart and shattering to the ground at or even before full maturity.

In 1989 the State of Utah Department of Agriculture initiated a project titled "Development and Demonstration of Commercial Seed Production Practices" utilizing T24808.

Salt tolerances of T24375 were documented finding germination at 12 days was not significantly reduced by concentrations up to 4 g/l of NaCl, a solution having EC of 7.3 mmhos/cm and -3.2 bars of osmotic potential.(Boukheloua, 1990).

PROJECTS, TRIALS AND REPORTS

Data in its complete report form is maintained by the individual agencies and is on file at the Upper Colorado Environmental Plant Center.

The following UCEPC Projects have either annual reports for the duration of the project and if terminated have a summary report. Individuals involved with the following projects: Glen Carnahan, Jarrell Massey, Sam Stranathan, Weidong Guo, Danny Goodson, Gary Noller, Randy Mandel.

Project 08I001 Native forbs at the UCEPC. Native collections expressed 60 to 75 per cent survival.

Project 08I058 Initial Evaluation of 46 Accessions of Sweetvetch. Wild harvest seed is extremely variable in quality between sites. Direct seeding was sporadically successful, perhaps reflecting seed quality variability and techniques. Significant variations were expressed throughout the collection. A standard performance profile was established allowing comparison of other plantings. Performance of introduced Hedysarum accessions were initially more aggressive but short lived compared to the Utah sweetvetch accessions. Seed born insects were observed.

Project 08I072 Initial Evaluation of 42 Accessions of Utah sweetvetch.

Project 08S093 Seed increase/production trials of Utah sweetvetch.

Project 08S133 Seed increase of 9024375 Utah sweetvetch.

Project 08S189 Seed increase of 9024808 'Timp' Utah sweetvetch.

Project 08S190 Seed increase in spaced planting block of Utah sweetvetch 9038330.

Project 08A111 Advanced evaluation of interagency Utah sweetvetch accessions.

Project 08A112 Kaiser/Sunnyside, Utah Mine Site Utah sweetvetch component.

Project 08A126, 08A127 Piceance Basin, Horsedraw evaluation of establishment and wildlife use of Utah sweetvetch.

Project 08A121 Direct seeded forbs and shrubs at Colowyo Coal.

Project 08137 Direct seeded forbs and shrubs at Soda Lake wildlife area near Pinedale, Wyoming.

Project 08A149 Utah sweetvetch selection.

Project 08A172 Direct seeded forbs, shrubs and grasses at Coyote Draw, Duchesne, Utah.

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