TEN YEARS OF TESTING FOR WATERFOWL FOOD PLANTS IN CALIFORNIA

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ABSTRACT

Over the past thirty years, a need has developed for plants to improve the wetland habitat in California. This report is the culmination of ten years of testing in search of waterfowl food plants. Many of the plants evaluated have potential for waterfowl food, but most have cultural and management technique problems. In the spring of 1958, cooperative studies were initiated to develop better waterfowl food plants. This work was authorized by a three-way agreement between the California Department of Fish and Game, the California Division of Soil Conservation and the USDA's Soil Conservation Service. Cooperative work plans were developed for screening over 700 accessions during the 10-year study. The systematic plant testing program of the Soil Conservation Service was used to screen the plants for waterfowl food. The major phases of testing were: 1) initial screening at the Pleasanton Plant Materials Center (now located at Lockeford, California); 2) field evaluation plantings at the Gray Lodge Wildlife Management Area near Gridley, California; and 3) field plantings at eleven sites throughout the Sacramento-San Joaquin Valley.

INTRODUCTION

Waterfowl migrating along the Pacific Flyway find California's wetlands to be excellent wintering grounds. However, each year waterfowl habitat is reduced as land uses change. This reduction in waterfowl habitat was recognized years ago and was the prime reason for initiating a waterfowl food plant testing program in 1958. Since the U.S. Department of Agriculture, Soil Conservation Service (SCS) had experience in resource planning on farmland and the California Department of Fish and Game (CDFG) had knowledge and experience in waterfowl management, an ideal situation existed for a successful cooperative venture.

In the spring of 1958 a three-way agreement was formed between the California Department of Fish and Game, the California Division of Soil Conservation and the SCS. The initial testing of plant materials for waterfowl food took place at the SCS Pleasanton Plant Materials Center (PMC), now located in Lockeford, California. Most of the secondary testing took place at the CDFG Gray Lodge Wildlife Management Area near Gridley, California.

METHODS AND MATERIALS

The SCS Plant Materials Centers utilize a unique process through which plant materials are tested and evaluated (Table 1). Initital testing for this project began in the spring of 1960. There were many grass and forb varieties to be assembled and screened, so plants were arranged into use groups. These groups were extensive but for purposes of this discussion three broad categories were defined: 1) perennial grasses and forbs; 2) summer active annual grasses; and 3) summer active annual forbs. Criteria used to evaluate each plant asscession were: 1) water requirements; 2) seed and forage production; 3) availability of food based on the physical features of the plant; 4) availability of food based on time of maturity of the plant; 5) seed shattering; 6) freedom from depredation by non-game birds; 7) seedling emergence, vigor and establishment; 8) characterisitics of the seed; and 9) disease resistance.

Table 1. The USDA-SCS Process by Which Improved Plant Materials are Cooperatively Developed and used in the Conservation Program.

(1) Identification of Problem and Vegetative Needs

(2) Assembly of Plant Materials - Native, Introductions

(3) Initial Evaluations, in Comparison with Standard, at Plant Materials Centers

(4) Initial Seed and Plant Increase

(5) Advanced Evaluations, in Comparison with Standard, at PMC, or Off-Center Sites

(6) Field-Scale Seed and Plant Increase

(7) Final Testing in Field Plantings, in Comparison with Standard, in Conservation Districts

(8) Name and Release of New Cultivars with Experiment Stations and Other Agencies

(9) Production of Foundation Seed and Plants

(10) Commercial Production of Released Cultivars

(11) New Plant Cultivars Available for Use

At the Pleasanton PMC, grass and forb accessions were seeded directly into artificial ponds. Rows were 20 feet long and spaced 30 inches apart. Each of the use groups was planted in a separate pond so that conditions could be regulated for optimum growth. Throughout the growing season, detailed records were kept on plant performance. At the end of the season each plant accession was harvested and air dried. Seed and forage were separated and yields determined for each.

Between 1960 and 1970, 706 accessions were evaluated in initial testing at Pleasanton. The major genera (and accessions within each) are shown in Table 2. Of all the accessions evaluated, only fifteen were chosen to enter the secondary testing stage of the program. All fifteen selections went through initial seed increase at Pleasanton to provide see for the field evaluation planting (FEP) at Gray Lodge. Several named varieties of grasses and forbs were also included in the FEP.

Some testing was done at Gray Lodge between 1960 and 1962, but the bulk of the secondary testing began in 1962 as plants began to emerge from initial screening at Pleasanton. For the actual FEP site, a field representative of the waterfowl wintering grounds in the Sacramento-San Joaquin valley was selected. Soil series were identified as Castro and Snelling. Snelling soils are deep with a hardpan at about 36 inches. Castro soils are moderately deep with a hardpan lying between 20 and 36 inches. Both soils are non-alkaline and non-saline but poorly drained.

Prior to the establishment of plots, the test area had been intermittently cropped to rice and barley. During the spring of 1961 the field was plowed and fallowed. In the spring of 1962 12 acres were disced and leveled. Plots were layed out in 24 x 450 ft. blocks. Each plot was so arranged that it could be irrigated independently of the others. Plots were planted with a grain drill at a rate of 20 lb/ac.

Table 2. Major genera tested at the Pleasanton PMC. The number of accessions is shown in parentheses.

Year	Use Group a/ (No. of Accessions)		
	A	B	C
1960	Scirpus (11) Eleocharis (2)	Brachiaria (1) Echinochloa (24) Heleochloa (1) Panicum (6) Setaria (4)	Fagopyron (1) Iva (1) Salicornia (1) Polygonum (12)
1961	Setaria (58) Scirpus (1)	Setaria (190) Echinochloa (25) Pennisetum (1)	Polygonum (8)
1962	Panicum (3) Setaria (1)	Panicum (32) Setaria (1)	Polygonum (10) Dorycnium (1)
1963	Alopecurus (4) Panicum (9) Agropyron x Triticum (1)	Echinochloa (20) Eleusine (13) Setaria (5) Beckmannia (5)	
1964	Scirpus (18) Heleocharis (3) Sparganium (2)	Beckmannia (7) Echinochloa (4) Heleochloa (2) Panicum (21)	Atriplex (14) Polygonum (3)
1965	Polygonum (2) Scirpus (23) Heleocharis (6) Carex (1) Atriplex (6) Alisma (2) Sagittaria (4) Sparganium (5) Potamogeton (1)	Echinochloa (8) Eleusine (5) Dactyloctenium (1) Panicum (8) Phleum (6) Setaria (5) Sorghum (6)	Echinodorus (3) Polygonum (15) Atriplex (12) Chenopodium (1) Rumex (1)
1966	Atriplex (6)	Echinochloa (4) Panicum (105)	Polygonum (5)
1968	Beckmannia (1) Panicum (1) Puccinellia (5) Setaria (1) Paspalum (2)	Brachiaria (1) Echinochloa (3) Eleusine (1)	Fagopyron (2) Polygonum (3) Carum (1) Swainsona (1)

a/
- A Perennial Grasses and Forbs
- B Summer Active Annual Grasses
- C Summer Active Annual Forbs

Criteria used to evaluate the field evaluation plantings were: 1) water requirements; 2) seed and forage production; 3) availability of food based on the time of maturity of the plant; 4) seed shattering; 5) freedom of depredation from non-game birds; 6) seedling emergence, vigor and establishment; 7) competitiveness; 8) self-perpetuation; and 9) disease resistance. During this FEP stage all testing and cultural treatments were handled by SCS and/or CDFG personnel. Table 3 shows, by use group and year, the plant assessions tested.

Table 3. Plant accessions tested at Gray Lodge by year and use group.

Year	Use Group[a/]	Accession
1962	B	Echinochloa crusgalli (4 accessions)
	C	Polygonum lapathifolium
	C	Polygonum pennsylvanicum
	A	Lotus tenuis, Los Banos variety
	**	Vicia dasycarpa, 'Lana" vetch
	A	Phalaris arundinacea, P-2369
	B	Festuca arundinacea 'Goar'
	A	Agrophyron elongatum 'Alkar'
1963	B	Echinochloa crusgalli (2 accessions)
	B	Setaria lutescens
	B	Setaria italica
	B	Setaria viridis
	A	Scirpus robustus
	A	Dorycnium hirsutum
1964	B	Echinochloa crusgalli (3 accessions)
	B	Setaria italica
	B	Panicum miliaceum (4 accessions)
	A	Panicum antidotale
1965	A	Alopecurus arundinacea (3 accessions
1966	C	Atriplex hortensis

a/
- A Perennial Grasses and Forbs
- B Summer Active Annual Grasses
- C Summer Active Annual Forbs

** Cool Season Annual Legume

The third and final stage of plant testing is the field planting. These plantings were made under actual use conditions to determine the plant's value as a waterfowl food plant. Plantings were made on soils or sites where there was a need for specific information about the adaption or performance of a plant. Field plantings are usually made where plant materials can be put to practical use. During this study, some field plantings were made on CDFG wildlife management areas as well as private farms and ranches. These field plantings were not under the care or management of the PMC. SCS and CDFG personnel did, however, evaluate and keep records annually on plant performance.

Only a few of the plant accessions that enter initial testing ever make it to a field planting. Only two species of waterfowl food plants, willow smartweed (Polygonum lapathifolium) and pink smartweed (Polygonum pennsylvanicum) were tested in field plantings. Between 1965 and 1971, 11 field plantings were made in cooperation with local Resource Conservation Districts, CDFG and private landowners. These field plantings were distributed throughout the Sacramento-San Joaquin Valley.

RESULTS AND DISCUSSION

Ten years of testing did not result in an outstanding variety of waterfowl food plant. However, the hundreds of hours of work spent screening plant materials did result in valuable information that should be of use to others contemplating a study of this type. This paper will only discuss the performance of plants selected for secondary testing (Table 4) since all other accessions were eliminated during initial testing.

Table 4. Plant species selected for secondary testing at the Gray Lodge Wildlife Management Area. The number of accessions is shown in parentheses.

	Year Selected
Echinochloa crusgalli (3)	1960
Polygonum lapathifolium (1)	1960
Polygonum pennsylvanicum (1)	1960
Scirpus robustus (1)	1961
Setaria viridis (1)	1961
Setaria lutescens (1)	1961
Setaria italica (1)	1961
Panicum miliaceum (4)	1962
Dorycnium hirsutum (1)	1962
Atriplex hortensis (1)	1964

The watergrass (Echinochloa crusgalli) accessions included an early, intermediate and late maturing strain as well as a commercially available variety which served as a check. All watergrass accessions matured unevenly and shattered seed. They decreased in seed and forage production after the first year. The three selected accessions held to their selected characteristics for two years. After three years identifiable traits were lost. Contamination from indigenous watergrass plants probably accounted for the first year uneven maturity and subsequent loss of selected traits. Seed and forage yields for all accessions were greatest in the establishment year. After three years all plots tended to show similar characteristics due to competition and contamination from indigenous watergrasses.

Of all plant accessions tested, willow smartweed (Polygonum lapathifolium) looked the most promising. It was superior to the other smartweed accession, pink smartweed, throughout the testing period. Willow smartweed retained its selected traits throughout the 5-year evaluation period at Gray Lodge. Length of maturity ranged from 61 to 80 days and the seed to forage ratio was 1:3, the best of any species tested. This accession was free of any apparent disease. Willow smartweed and pink smartweed were the only two species to be moved into field plantings. Establishment and cultural problems, however, prevented them from being carried any further. If cultural practices could have been refined, the willow smartweed accession might have been developed and released as an improved waterfowl food plant.

Stands of Alkali bulrush (Scirpus robustus) were never successfully established. Difficulty was experienced in handling small lots of seed. Intense competition from volunteer vegetation also contributed to its failure. Salt tolerance shown by some varieties during initial testing indicated potential value as a waterfowl food plant.

Yellow bristlegrass (Setaria lutescens) was the only Setaria species to show potential as a self-perpetuating annual. All three Setaria accessions produced abundant seed and forage the first year but only yellow bristlegrass did so in subsequent years. Foxtail millet (Setaria italica) showed potential for use as an annually seeded waterfowl food plant. The proso millets (Panicum miliaceum) were not self-perpetuating and all produced less seed than foxtail millet.

Hairy canaryclover (Dorycnium hirsutum) failed to establish a stand at Gray Lodge and was immediately dropped from any further testing. Los Banos narrowleaf trefoil (Lotus tenuis) was planted as a comparison against hairy canaryclover. It produced a fair to good stand the first year, improved over the next two years, but then declined.

Graden orach (Atriplex hortensis) looked very good in initial testing but performed poorly at Gray Lodge. Only 16 lb. of forage were harvested the first year and no seed was produced. It did not perpetuate itself in the following years.

One annual legume, 'Lana' vetch (Vicia dasycarpa) and three perennial grasses, reed canarygrass (Phalaris arundinacea), 'Goar' tall fescue (Festuca arundinacea), and 'Alkar' tall wheatgrass (Agrophyron elongatum) were established to act as barrier strips between plots. Detailed records were not kept on their performance but these species did show potential for use as goose pasture.

CONCLUSIONS

Several plant accessions exhibited characteristics which set them apart as having real possibilities for development into improved waterfowl food plant varieties. However, the cultural practices necessary for economical seed production as well as successful stand establishment were not well known. Seed of most species was available as a by-product from other seed cleaning operations. Since none of the tested species showed the superiority necessary to justify further study, the project ceased. However, with changing concerns over the last decade, studies of the development of waterfowl food plants may again be warranted. This project can serve as a basis for any new study of this type.