

## Plant Selection and Breeding in Relation to Soil Conservation

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(Presented December 28-29, 1937, at the Annual Meeting of the Northwest Scientific Association, Spokane, Washington.)

### INTRODUCTION.

Throughout the Ages Selection of seed from the most desirable plants has been a powerful tool for increasing the prosperity of the people. It is an artificial acceleration of the Survival of the Fittest for the uses of men,—whether that use be food supply, clothing, shelter, or conserving the soil for generations yet unborn. Breeding increases variation, and, properly guided, brings together the desirable characteristics of different varieties into a new variety which, selected and increased, surpasses its inferior parents.

Soil conservation implies not only keeping the soil where it is in spite of wind and water, but also maintaining the fertility of the land while providing food and raiment for man and beast.

Hordes of gullies now remind us,

We should build our lands to stay;  
And departing leave behind us,

Fields that have not washed away.  
Then when our boys assume the mortgage

On the land that's had our toil,  
They'll not have to ask the question,  
"Here's the farm, but where's the soil?"

The relation of plants and soils is primarily the surface contact from the conservation standpoint, and each type of soil requires a different group of plants for the best coverage. One group is required for swampy ground, another for hillsides—and a north slope may require different species from a south slope—clay points call for one type of vegetation, acid and alkaline soils require different types of plants, and arid soils and scab lands require plant life

adapted to drought and temperature extremes if the greatest coverage is to be obtained.

In selecting the crop for a given field, uses other than soil conserving must be kept in mind as well, or the crop venture may fail because it won't pay the taxes and support the family. It isn't enough to conserve the soil unless revenue to support the present population is furnished. This objective means a change in rotations of part of the land, with soil-depleting crops alternating with soil-building crops, and also involves changes in time and methods of tillage, returning the crop residues to the soil, and putting part of the farm down to permanent meadows and pastures. These changes in practice will not come easily. It will take a generation or two of education and trial and error, plus Government subsidy, to bring about changes in America comparable to the best European practices. The development, by breeding and selection of plants adapted to the conservation program, may make application possible where failure would result without it. It should hasten the change in any case.

### SELECTION FOR PARTICULAR PURPOSES.

Since any soil conservation program, to be accepted, must compromise with soil depleting crops for economic reasons, the improvement of grain crops might be considered in the rotations where they are included. For example, in the most popular rotation in the eastern half of the Palouse Country, wheat and peas, a step in the right direction would be to insist on **spring** wheat and peas, for winter wheat encourages ero-

sion. From 1930 to 1934 rotations showed 93 cents more net returns per acre when spring wheat was used. The spring wheat should be short of straw so that the farmer may disk it in or plow under the residue, rather than burn it. While selecting for short straw, breeding and selection might well be carried on for greater yield, and for resistance to smut and the rusts as insurance against epidemic years like 1937, which took a million bushels or so from the Palouse Country with rust. Similar selection should be made with oats and barley which could be substituted for spring wheat.

Already much progress has been made in selecting wilt-resistant peas. If the pea moth becomes prevalent or the pea weevil gets worse, varieties of chick peas, lentils and soybeans adapted to the pea area but immune to these pests should be ready to take their place.

But this two-year rotation of grain and annual legume is far from an ideal soil conserving rotation. It is, however, better than winter wheat and summer-fallow and has been much more profitable, therefore a step in the right direction. The next step might be to add a grass seeder to the drill and sow sweetclover with the peas. This would make a three-year rotation of peas, sweetclover, and spring grain. The sweetclover could be plowed under in June or perhaps pastured, or a hay crop taken from the more fertile areas, then plowed under later. A few farmers might leave the crop until September and take off a seed crop, plowing still later, since in any event the ground should be left rough and loose until the following spring. After the wheat crop, the field should again be fall-plowed and left rough for peas the following spring.

What variety of sweetclover would be best in such a rotation? That would be determined by experiment. Possibly

White Madrid, Yellow Madrid or Wil-lamette, the stem-rot resistant variety, would produce too much top growth for turning under, while the more leafy, fine-stemmed dwarf varieties or Alpha type might be more effective in retarding run-off and produce a better hay and higher priced seed. The ability of the Madrid varieties to grow at low temperatures early in the spring and late in the fall is valuable for erosion control as well as for pasture. By hybridizing these two types, an "Alpha" type that would grow at low temperatures might be selected. It is well to anticipate all the possibilities as 10 to 20 years might be required to develop and increase the desirable type for this particular need.

Alfalfa is probably the most useful perennial legume for the longer rotations in the Palouse Country as a forage and as a soil conserving crop. It merits special research in breeding and selecting for type of growth, winter-hardiness, disease resistance, drought resistance, seed-setting, and yield of hay and pasture as well as ability to get along in various grass mixtures. Since alfalfa is universally grown, the introduction of seed from the four corners of the earth would be a good first step in obtaining variations and possible parent material. To a large extent this has already been done. More study is needed concerning the possible grass mixtures both from the standpoint of the hay crop and from that of the control of undesirable cheat grass as well as erosion control. If the proper grass could be selected to control cheat, it would not only save valuable time in eliminating the spring disking or springtooth-ing of the alfalfa, but would save some spring washing and produce a cleaner, brighter, clod-free hay. Smooth brome is a promising grass with alfalfa, but much testing needs to be done with different rates and different strains of

the two species. Other grasses such as tall meadow oat, slender wheat, crested wheat, and orchard are well suited for growing with alfalfa under certain conditions.

On almost every farm there are certain draws and flat areas that are too wet for normal cultivation. On these areas timothy, alsike and white clover, the bluegrasses, and redtops do well. All of these species could no doubt be improved by local breeding and selection. The testing plots should be in these wet places where they are to be used if usable results are to be obtained. They should be grown in mixtures as well as in isolated stands for comparative testing, and different types of tolerance must be looked for. Ability to live and grow with their roots in the water in the spring is one essential. Rate of growth and quick recovery when cut or grazed is another. Ability to live a long time or to reseed readily is an advantage for any permanent pasture. Ability to lie dormant during unfavorable weather is another.

Nearly every farm in the Palouse area also has clay points and infertile hill-tops that could be profitably seeded down to trees or perennial grasses. For these special species are needed, and a crop improvement program for more adapted strains of each species would pay large dividends. Who will say that there are not strains of black locust and crested wheatgrass better adapted to clay points than others? In establishing a tree covering it has been considered good practice to cultivate the trees the first year or two, but when cultivation becomes impracticable, should wheat be planted for handy game-bird food or should Jim Hill mustard and China lettuce be allowed to come in and take possession? Or would a grass sod be better mixed with sweet-clover and alfalfa? Should the trees be

pruned or allowed to grow and sprout at will?

These questions force upon us the idea that we are to select and breed plants from a new viewpoint. We must use a different yardstick, if you please, in measuring the value of new plants. Soil conservation is primarily a management problem, but just the right selection of plant species and varieties is a great aid in bringing about the desired end. The Regional Soil Conservation Nursery at Pullman has brought together a large array of plants from far and near for testing and observations. The more promising ones are further tested on widely different locations. Those of proved worth are distributed. At the same time new introductions come in for testing and recombinations of old varieties are made with the plan to develop more useful and more hardy strains than are now available. It is possible that this nursery will be distributing selections 100 years from now that are not in existence at the present time. And that they will be sown or set out by men whose fathers are yet unborn.

The process of breeding and selecting by the performance test takes time, and may be considered a continuous process. The difference between the plant improvement program of the future and the past lies in the change of emphasis from the cereal crops to the forage crops. There have been attempts to hybridize the annual cereals with perennial grasses, but the results have been discouraging so far. Whether a satisfactory grain crop can be grown from perennial roots remains to be proved. If such a crop could be developed even at a considerable loss in yield, it would be very valuable in conserving the soil through reducing cultivation. A larger seeded perennial might be more easily established under adverse conditions. A sod cover, especially on hilly land, is

the best possible. While terraces and gully obstructions are valuable in controlling erosion and in reclaiming eroded land, these devices are not adequate without a vegetative cover.

In annual, biennial, or perennial crops the parts which save the soil are those which are in contact with the surface. For this reason, preference should be given to fine-stemmed, leafy types. Pastures with stoloniferous plants that root at frequent intervals make good coverage. The Kudzu vine of the South with this habit of rooting at the joints is a very popular legume with the soil conservationists. The dangerous quackgrass may have a place in abandoned areas as a soil binder, as it meets many of the requirements of soil conservation. The unpalatable *Elymus* species should be given consideration around waterholes and where over-grazing is most probable. Sagebrush is better than nothing in over-grazed blow areas.

Every plant has its parasites. Especial care must be exercised in selecting strains that have some resistance to its major fungous, bacterial, or mosaic diseases and insect predators. This point is more important with perennial plants because of the high cost of getting a stand and the infrequency of changing to another crop. Relative ability to choke out noxious weeds needs attention for the reason that it is probably the most inexpensive way to control them and from the standpoint of conserving the soil is much more desirable than using chemicals or clean cultivation.

Weeds are useful on waste places and idle land as soil conservators, but useful plants that would conserve the soil equally well should replace them wherever possible. Public expenditures for planting roadsides to useful grasses, legumes, and shade trees as a means of preserving the road bed, preventing weed seed spreading to farm lands, and

increasing the scenic beauty of the country would be a wise use of road funds if properly directed. Permanent plantings can be stimulated to greater weed control by the use of commercial fertilizers if the right combination is applied. Special studies in this field of selection are advisable and justifiable.

A few of the more important species of soil conserving crops that have high pasture and hay values may be listed: bluegrass, bromegrass, wheatgrass, orchard grass, timothy, red top, tall meadow oatgrass, Reed canary grass, fescues, ryegrasses, alfalfa, sweetclover, white Dutch clover, alsike clover, and Indian ricegrass.

Special selection and breeding work on all of these and no doubt many others might yield increased value in soil conservation and economic returns of hay and pasture, if used on soils and in climates to which each is best adapted. Crops are the products of the soil, but it is equally true that soil is the product of the crops that have been grown upon it. Proper management in the sequence of crops, establishing a stand, and utilization of the growth is essential for a permanent agriculture.

The social value of a permanent, self-sustaining agriculture as a national asset should not be overlooked. Instead of mining the soil by the wheat-summer-fallow system and after it is worn out and gullied until farm machinery can no longer travel over it, why not diversify and put back into the soil each year as much fertility as has been removed by crops? By careful planning over a long period of time with a proper sequence of crops, combined with wise management and cultivation practices, could not erosion be practically eliminated? Would not these changes encourage home ownership and a decrease in tenant farming? Would it not encourage smaller farms with the best blood remaining on the land? The open

country has long been considered the breeding ground of the nation. Farm families are much larger on the average than city families. Dr. Carver of Harvard is the authority for the statement that three generations of city life brings about complete sterility.

A permanent agriculture would pro-

mote rural home life, with pure bred stock, pure seed production, and a continuance of the family farm from generation to generation. A large group of such families would make any nation great, for such land will grow better statesmen as well as better crops and flocks.