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GREEN-MANURING PLANTS FOR ORCHARDS.

(REPRINT)

During the past year the Arizona Experiment Station has been testing plants that gave promise of being useful for plowing under to improve the soil. Special attention has been given to plants suitable for growth in orchards. The two best plants tested were *Melilotus indica* and alfalfa. The Melilotus is the plant commonly called "sour clover" in Arizona. Elsewhere it is known as Yellow sweet-clover or Bitter Melilot. It belongs to the same genus as White sweet-clover (*Melilotus alba*), the flowers being yellow instead of white. It is an annual, while the white-flowered Melilot is a biennial.

Yellow sweet-clover—(sour clover)—grows naturally throughout the Southwest, being commonly considered a weed. In southern Arizona it is quite common in grain fields, these being the source of the seed used for sowing in orchards. Seed can be obtained where grain has been threshed, or at grist and rolling mills, the cost being slight.

The seed will germinate only during the cool weather from September to April. The earlier it is sown in the fall the more growth will be secured for turning under in the spring. If sown the latter part of

September or the early part of October it will ordinarily attain a height of three to six inches before being checked by the cool weather of December and January. It may be sown as late as December, but will not give as heavy a yield as if sown earlier. About 50 pounds of seed should be sown per acre

The method of seeding found to be the best is to level the ground well, sow broadcast, furrow with a three-shovel furrower, roll, and irrigate by running the water in the furrows, which should be two or three feet apart. Irrigating it frequently during the winter will not only increase the yield, but will benefit the orchard.

It should be plowed under when beginning to blossom, which will ordinarily be early in April. At this stage the yield proved to be 15 to 18 tons of green matter or 3 to 4 tons of dry matter per acre last April. If permitted to grow longer it becomes more woody, does not turn under so well and decays less rapidly. By attaching a chain to the plow all the growth can ordinarily be turned under.

The alfalfa may be sown earlier than the clover, as the seed will germinate during warmer weather. It does best if sown in the same manner as described for clover. As it does not grow as rapidly during the winter, it will usually not be ready to plow under as early. Thirty pounds of seed per acre will be sufficient.

Peas sown very thickly (125 to 200 pounds per acre) during fall or winter will give a small yield of vines and in addition furnish a supply of green peas. The best varieties for this purpose were found to be Yorkshire Hero and Champion of England.

The White sweet-clover already mentioned makes a luxuriant growth during the summer, but grows little during the winter when the trees are dormant. For summer growth it seems to be no better than alfalfa. If permitted to grow two seasons, it dies at the end of the second. It may be plowed under green, or simply be allowed to die and decay upon the surface.

The benefits from the winter-grown green-manuring crops are four-fold at least. In the first place, the soil is thus covered during a portion of the year and the exhaustion of decayed vegetation by the heat of the sun retarded. In the second place, plant food that would be otherwise washed away by rains and irrigation is appropriated by growing plants and thus saved for the tree. One of the most important benefits is the improved physical condition of the soil, due to the de-

caying of the green matter turned under. This causes the soil to bake less after irrigation and to hold its moisture longer.

The chief benefit to the trees comes from the addition to the soil of nitrogen, one of the most important plant foods. The nitrogen added is derived from the air mixed with the soil. Most plants are powerless to use nitrogen from the air with which they are surrounded, notwithstanding the fact that the latter contains about 80 percent of this element. The members of the pea family (peas, beans, clovers, alfalfa, etc.) are an exception. They harbor upon their roots colonies of microscopic plants called bacteria which have the ability to absorb nitrogen and pass it along to the plants to which they are attached. The irritation produced by these colonies of bacteria causes the formation of small nodules or knots by which their existence upon the plants may be known.

The plowing under of plants that have secured their nitrogen elsewhere than from the soil adds to the latter the nitrogen thus secured, and in addition benefits the soil in the ways mentioned above.

It has been found by W. M. Ward, one of the leading orange growers near Phoenix, that, after sowing the Yellow sweet-clover seed one or two seasons in an orchard, enough seed will mature under the trees and in other places not reached by the plow, to seed the orchard from year to year, the only work necessary being furrowing during early October and subsequent irrigation. Mr. Ward was one of the first men to sow the Yellow sweet-clover for this purpose, having begun its use several years ago. He believes it has been of great benefit to his orchard.

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