SUCCESSFULLY ESTABLISHING ALFALFA ON CLAY SOILS IN THE SACRAMENTO VALLEY

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IN BRIEF

Growing selected varieties of alfalfa in shallow soils or soils with periodic high water table have been profitable. Alfalfa plants, to remain vigorous, require adequate drainage within hours of irrigation to at least crown depth, which may be at 2" to 3". The bedding or corrugation will provide this drainage. Elements P, K, S, and Ca, that alfalfa plants require, may be less available in heavy soils and detection of this situation may require some different soil testing methods.

Fertilizer supplements P, K, and Ca should be plowed down or banded before planting. Fields of heavy soils should be seeded at 20-25 pounds minimum. Coated seed has been observed to germinate earlier and seedlings grow faster in mid to late fall plantings on heavy soils. September plantings have the best chance of producing a high density spring stand when a wet winter follows seeding. Sprinklers, flood, and sub-irrigation have all been used to advantage in establishing alfalfa. Drains must be adequate to prevent water from standing at field ends for prolonged periods during the winter.

The ability to grow alfalfa on heavy clay soils, dense soils, and soils with water table problem is not acquired casually. It would be my recommendation to those of you who tend to be casual "hip shooters" to find some other means to lose your money or the bank's. Low yields and short-lived stands just won't pay the bills.

Alfalfa is a relatively easy crop to grow and establish on fertile soils with high moisture holding capacity and good internal drainage, however, these soils in the Sacramento Valley are being used to grow crops that produce higher incomes per acre. Consequently we have had to come up with new techniques to grow alfalfa on problem soils formerly known to be unsuitable. I want to recognize the fact that successful fields have been established on "unsuitable soils" without using many of these techniques. However, it has been my experience that these fields are more vulnerable and the growers at higher risk to lose their investment or the income that could have come from longer lived denser stands. Many of our problem soils will produce 10 tons of alfalfa hay per acre but only 40% will be premium hay. The remainder will receive major discounts if sold during the growing season. Most growers' fields will only produce 6 to 7 ton yields of 54 TDN or better hay, so they have to receive premium prices.

VARIETIES

Our current success in obtaining a dense stand of long-lived alfalfa on these problem soils is for a good part tied to the selection of an alfalfa variety that has these characteristics: High level of phytophora resistance or re-rooting ability; low spreading crown; semi to moderate dormancy; and the ability to

survive 4 years of a mid-summer cutting cycle of 28-30 days. In addition, we are looking for varieties where all the plants are uniform in maturity and growth rates in addition to slow recovery following the cut.

Many of the varieties promoted for use in these soils are entirely unsuitable. We know of no plant breeder presently developing alfalfa varieties with stand longevity and the yield of 54 TDN hay as the major selection criteria. When we find useful long lived varieties, we are fortunate, indeed.

HERBICIDES

Herbicides often react differently on problem soils. Care must be taken to avoid herbicide residues from previous crops, which might cause seedling damage.

SOIL FERTILITY

The problem soils that we deal with often have the ability to tie up phosphorus and potassium. Our studies and experience have shown no economic benefit to the grower from surface-applied phosphorus and potassium. We also find these soils might have low pH and also be low in sulfur. A typical field might require applications of phosphorus (P), potassium (K), sugarbeet lime (Ca), and elemental sulfur (S) plowed down at planting. Soil tests are used to evaluate the available levels of these nutrients. However, one must use caution when reviewing lab data. Not all soil testing methods are useful on our problem soils. For example, we find the standard ammonium acetate method for K to over-estimate the level of potassium available for alfalfa in our clay soils. However, we find that if we use it and the hot nitric acid extraction for total K, we obtain some useful numbers.

FIELD FLOOR

Flood irrigation works well for alfalfa on heavy clay soils providing there is adequate surface drainage. Three configurations are being used to advantage in irrigating alfalfa growing in heavy soils: 1) The basin flood; 2) The border check with corrugations; and 3) the bedded field with stub borders at the headland.

The basin-flood has been used in 20-acre fields leveled for rice. Drain ditches were created at 60-feet intervals in the fields. These joined with major drains or delivered excess water to sump pumps. Water delivery had to have high capacity and surface water had to be off the field in 4-1/2 to 5 hours to avoid scald. This system requires excellent timing and management for use in the Sacramento Valley.

The border-check system with corrugation is a compromise between bedding and the flat check. For about 3 years, the corrugations provide enough surface drainage to allow the nodules on the alfalfa roots to provide nitrogen for plant growth. However, many of these soils become liquid when wet and the 3" deep corrugations lose their effectiveness when they become mere shallow depressions.

The bedded field has advantages over the methods mentioned before. Because there are borders only at the headlands, irrigation to germinate the seed, is easier and/or less expensive. The plants growing on beds will withstand conditions

that would cause loss of nodules and fine roots or scalding in either the basin or the corrugated border-check system. It is more suited to the talents of the average irrigator. The problem of equipment wheels falling in the furrows is usually and easily solved with dual tires or wider tires.

Growers, more concerned with being able to turn equipment in the middle of the field, often use the flat border-check method that is so effective on soils with better internal drainage. You can easily recognize these fields. The second year we see the beginning loss of stand in the middles and abundant growth on the borders. By the third year, it becomes more obvious that, for this grower, alfalfa is not a money-maker. We don't think that being able to turn in the middle of the field will save enough money to compensate.

Growers interested in using the basin or corrugated border-check method of irrigation should concern themselves with the head of water available. Spring growth of alfalfa growing in heavy soil can show signs of water stress despite the fact that there is ample moisture below the 1-foot depth. Too much water, at this time, can cause loss of fine feeder roots and nitrogen fixing root nodules. However, the continued stress for moisture will stop stem growth and bring on leaf drop. If this is allowed to continue for very long, the quality and yield of the spring cut will suffer greatly. The only way to correct the problem is with "tidal wave" irrigation. A large head of water, tall borders and rather short checks may be needed. Optimum moisture in the active root zone is maintained much easier in bedded fields.

TILLAGE

Deep tillage has been found to be important in these clay soils. If the grower's soil tests have shown poor availability of any of these elements: phosphorus, potassium, calcium, sulfur, or a undesirable pH and, if he doesn't own a plow, we recommend that the fertilizers be applied before the deep tillage is done. If a plow is owned, then the fertilizer can be plowed into a depth of 8"-10". Banding of phosphorus and potassium has been shown to be very effective.

Preplant herbicides can be used with basin irrigation easily, however, there is more difficulty to achieve good weed control with corrugation and bedded fields. The primary problem xis, if the herbicide is incorporated before corrugation, it is possible for the treated soil to be removed from the corrugated area and weeds will grow there. Because of the depth of the furrow in bedded fields, the treated soil is more likely to be removed and weed will grow in the furrow.

Following fertilizer and planing and herbicide incorporation, bedding of the field can be accomplished. In the Arbuckle area, tomatoe bed shapers (60"-centers) have worked very well for some alfalfa growers. Other growers have used ditching shovels on a tool bar to form beds. Furrows should be 6"-8" deep. "Stub" borders are brought out 50' from the headlands to allow harvest equipment to turn and beds are ended 50' from the field drain.

Good drains should be formed before planting at the end of the field to take away winter water as well as summer water. While we have observed that seedlings of select varieties have been able to withstand the rigors of water 4' to 5' deep for

several winter days, it is best not to put your fields to this test. Even the hardiest variety will succumb when submerged for months during the winter.

Corrugation is done with a simple tool made in the farm shop. Corrugations should be 2-1/2" to 3" deep when the field has settled and 30" to 32" apart. Corrugators have been constructed to cover 16', and they are composed of an A-Frame that is attached to an angle iron platform. To this, 4' lengths of 5-3/4" O.D. pipe are welded. A short piece of used grader blade is fitted to the front of these pipes to form the corrugations.

SEEDING

Broadcast seeding by air is the most popular method of seeding. Some seeding is done by drop seeding, which simply means that the seed tubes are removed from a grain drill with a legume seed attachment. A metal sheet is attached to the drill so that the falling seed will strike it and scatter in a uniform pattern. These can be designed so very little seed will fall into the bottom of the corrugation or furrow where most of it eventually will die. Cleaning of the furrow or corrugation in the 4th or 5th year can be more of a problem when alfalfa plants are present.

COVERING SEED

Smooth rollers seem to work better when covering alfalfa on heavy soils. Many of these soils crack severely when wetted and then exposed to drying north winds. Ring rollers tend to promote wider uniform cracks which can dry the surface rapidly while smooth-rolled ground promotes random cracking following the same conditions.

IRRIGATING UP

Seedling alfalfa in the 2 to 3 leaf stage is vulnerable. Frost, drowning, and the winter grazing of birds have taken their toll of fields in past years. Early establishment of alfalfa seedlings makes them better able to withstand the elements and damage from animals. Many growers rent sprinkler systems to germinate the stands. Sprinklers are most effective if the grower has deep-irrigated the field prior to seeding.

If sprinklers are used on dry soils in early September, moisture is often gone from the seed zone before germination can take place. Seed viability in such a situation as this can be evaluated by placing some of the exposed seed between two pieces of moist paper towel. The toweling with the seed should be placed in a warm location. Germination as a result may take place in 3 to 4 days.

Bedded fields have been sub-irrigated up in many situations with excellent results. Corrugated fields may have problems in this situation. Flooding the unsettled soil may, to some extent, fill in the corrugations.

POST EMERGENCE HERBICIDES

Timing of the herbicide application is most critical in successful post emergence weed control. If a broad spectrum of weeds are present, it may require several different chemicals or

applications to clean up the stand for the first cutting. Weed control is very important, as dense weeds can bring about a significant reduction in the seedling stand.

PEST CONTROL

Alfalfa weevils can invade early planted alfalfa and cause severe damage. Stand losses of 40% to 50% have been caused by unchecked weevil damage. Foothill fields have been damaged by the crane fly larva and, as has been mentioned before, flocks of grazing migratory birds can cause severe damage.