Fresno County
Seed Crop Notes

University of California Cooperative Extension — November 1991

RESEARCH UPDATES

Research projects funded by grower and conditioner participation in the California Alfalfa Seed Production Research Board provide valuable information to the seed industry each year. Research efforts in the subject areas of weed control and desiccation, pollination, and cultural practices were funded during the 1991 production season. Annual summaries submitted by the project leaders are printed in this newsletter to bring you up-to-date on progress made during the year. If there are any production concerns which you would like to see addressed in the future, contact me and I will try to identify a researcher to submit a proposal.

Vegetation Management and Desiccation Studies in Alfalfa Seed Production

Project Leader: Bill B. Fischer, Farm Advisor
Cooperators: Dr. Shannon Mueller and Kurt J. Hembree

Three trials were conducted during 1991 to further evaluate the effectiveness of 2,4-DB amine plus an adjuvant for the control of broadleaved weeds in newly planted alfalfa. MON-13288-0.5g (an experimental compound) was evaluated at 3 rates (0.5, 1.0 and 2.0 lbai/a) to study its selectivity on newly established alfalfa and its effectiveness in controlling emerged weeds. Pursuit, Velpar, Kerb and Buctril were also evaluated alone and in combinations.

The effectiveness of a 15% formulation of Treflan granular was compared with the presently used 10% Treflan TR-10 formulation for parasitic dodder control.

In a desiccation trial the evaluation of Ignite was continued. Also, the effectiveness of diquat and paraquat was compared. Two formulations of endothall were evaluated.

Results:

2,4-DB amine (Butyrac 200) in combination with an adjuvant (X-77) provided comparably effective control of certain broadleaved weeds that was obtained with 2,4-DB ester (an herbicide no longer available.)

MON-13288-0.5g applied on alfalfa in the 2 to 4 trifoliate leaf stage retarded the growth of the alfalfa at all rates (0.5, 1.0 and 2.0 lbai/a) used. At 1.0 and 2.0 lbai/a rates it caused a significant reduction in yield at the first cutting nearly four months after treatment. This new experimental herbicide failed to control pineapple weed and some other weeds in the sunflower (thistle) family.

Pursuit (imazethapir) and Kerb (pronamide) exhibited good selectivity, however Kerb failed to control all weeds in the sunflower family and Pursuit did not control cudweed.

Treflan TR-15 (trifluralin 15% granular) controlled dodder as effectively as Treflan TR-10 (trifluralin 10% granular) applied at the same rates (2.0 lbai/a) of active ingredient per acre in a newly planted alfalfa field grown for hay. Some plots were treated once and others two times, each time 2.0 lbai/a was applied with fixed wing airplanes.

Ignite (glufosinate) continued to provide effective desiccation and it was more effective in delaying regrowth than the other desiccants used. Diquat and paraquat provided comparably effective desiccation when applied two times at 4 day intervals. Des-I-Cate (mono (N,N - dimethyalkylamine) salt of endothall) was more effective than Hydrothol (mono (N,N - dimethylamine) salt of endothall) applied at comparable rates with More-Act, an adjuvant.

A more detailed report is being prepared for submission to the Alfalfa Seed Production Research Board.

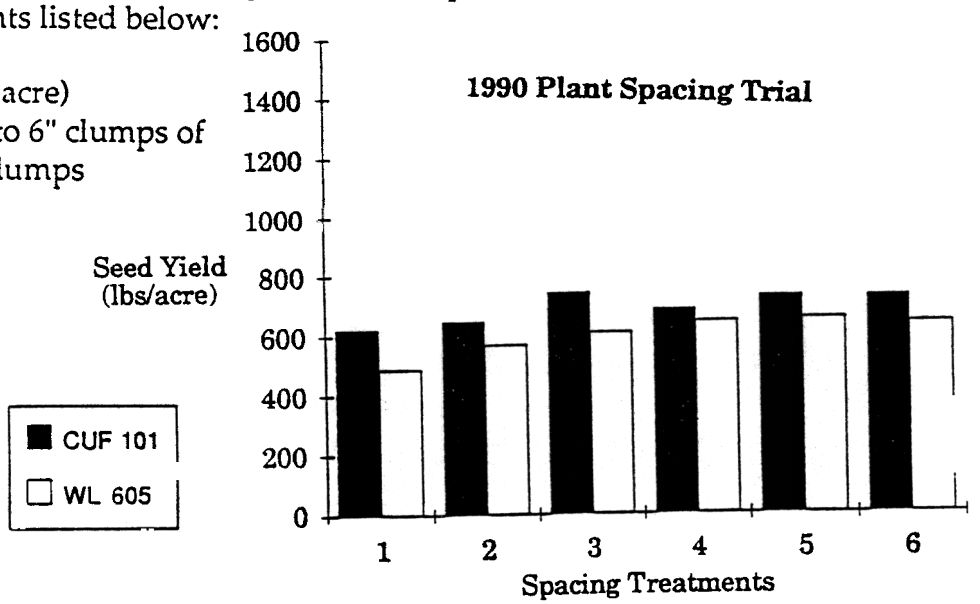
Optimizing Plant Spacing to Improve Alfalfa Seed Yields

Shannon Mueller, Agronomy Farm Advisor, UC Cooperative Extension, Fresno County

The density of plants within the row has a direct effect on alfalfa seed yield. Improved water use efficiency, pest control, and pollination are thought to be factors contributing to higher yields in thinned stands. In addition, higher seed yields may be associated with the level of carbohydrate reserves in plants. Plants with high root reserves produce more seed, more pods per stem, and more seeds per pod than plants with reduced carbohydrate concentrations (Dobrenz and Massengale, Crop Sci., 1966 and Granfield, J. Agric. Res., 1945). It has also been reported that cultivars respond differently to thinning with poor seed-producing cultivars responding more to thinning than high seed-producing cultivars (Pedersen and Nye, Utah Agric. Exp. Stn. Bull. 436, 1962).

Stand density can be controlled either by reducing the seeding rate or by thinning the stand once plants emerge (if weather conditions don't prevent equipment or crews from entering the field at the optimum time for thinning). The density required to optimize seed yields depends on bed spacing and soil type, which influence growth and final size of the alfalfa plant. The general recommendation for thinning a stand is to leave 6" clumps of alfalfa and remove 12" spaces along the row. There is less information available regarding planting a stand at lower densities to optimize seed yield. A trial was established in 1989 near Mendota to evaluate various plant spacings. Half of a 50 acre field was planted in the Fall (1989) to CUF 101 and the other half of the field was planted in the Spring (1990) to WL 605. Sixteen rows (1/4 mile long) of each treatment were planted on 30" beds. A John Deere 7300 vacuum planter, which can place seed at specific intervals, was used to establish the space planted treatments listed below:

1) Solid planted rows (1.5 lbs. seed/acre)
2) Solid planted rows later thinned to 6" clumps of alfalfa with 12" spaces between clumps
3) 4" spaces between seeds
4) 8" spaces between seeds
5) 12" spaces between seeds
6) 18" spaces between seeds



First Year Results Summary

The average yield from the Fall planting (CUF 101) was 691 lbs./acre and the average from the Spring planted section (WL 605) was 599 lbs./acre. Spaced plantings (4"-18" spaces between seeds) yielded significantly more than the solid planted or the hand thinned plots in both the Fall (13%) and Spring (21%) planted sections. Differences in water use efficiency were noticed during bloom and at the end of the season. In June, the solid plantings came into bloom first, probably as a result of more water stressed conditions due to higher plant populations. At the end of the season, the thinner stands (12" and 18" spacing) remained green and continued to bloom longer while the regrowth on the solid planted rows had fired and bloom was tapering off.

(continued)

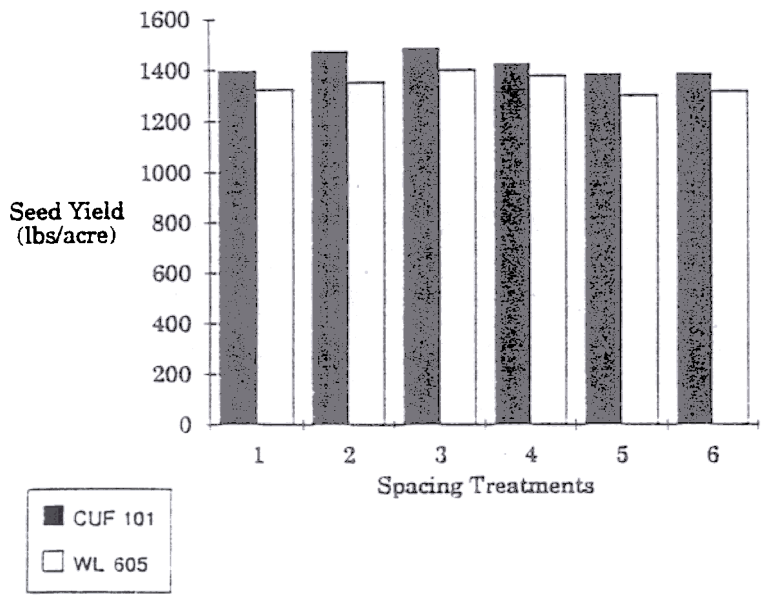
Second Year Results Summary

In 1991, the portion of the field planted to CUF 101 yielded an average of 1422 lbs./ac. The WL 605 section yielded 1270 lbs./ac. This year, there were no significant differences in yield between any of the treatments.

The trial area was irrigated only once in the spring (5/25/91), and no differences between treatments were observed in bloom or maturation. Since the trial is located over a shallow water table, differences in water use efficiency are difficult to detect once roots tap into the subsurface water supply. All treatments remained green and lush throughout the summer. This condition is not optimum for pollination by honey bees, but since leafcutter bees were used to pollinate in 1991, high yields were obtained despite the growing conditions. I believe the more aggressive pollination by the leafcutter bees overcame any differences due to spacing that might have been observed with honey bees.

There was low pest pressure this season, especially early in the year. High lygus pressure is thought to have a more negative impact on the solid plantings compared to the spaced plantings since pesticide coverage would be less in dense foliage. In thicker stands, under high pest pressure, more stripping might have been observed.

1991 Plant Spacing Trial



SELECTION FOR POLLEN COLLECTION IN HONEY BEES

Robert E. Page, Jr.
Department of Entomology
University of California, Davis

Alfalfa crop systems present difficulties for beekeepers and seed producers. Colonies dwindle in population during the time they are in alfalfa due to decreased brood rearing and lack of stored pollen. The lack of stored pollen may be a result of the "dislike" of worker honey bees for the alfalfa flowers which results in the reduced efficiency of honey bees as alfalfa pollinators. We designed an experiment to determine if strains of honey bees that were selected for the quantity of pollen they store in the comb show differences in stored pollen and brood quantity when used for alfalfa pollination.

Two way selection was applied for high and low stores of pollen in colonies of honey bees. Previous studies have demonstrated that workers from strains of bees selected for high and low pollen stores show high and low tendencies to collect pollen. Daughter queens were raised from queen mothers of generation two of each of the high and low strains and were allowed to mate naturally in commercial queen production apiaries. These test queens were then introduced into commercial hives May 10, 1991. Colonies were moved into the alfalfa in early June and evaluated for quantities of stored pollen and brood on July 18. High strain colonies had 24% more brood and 143% more stored pollen than lows. These results were statistically significant.

From these results, we conclude that commercially produced high and low pollen hoarding strains of bees differ with respect to pollen collecting and brood production. Next we need to test the high strain bees against unselected commercial stock to see if they are indeed better than what is commercially available and we need to determine if more pollen collecting results in more alfalfa seed.

COST SHEET UPDATE

The "current" alfalfa seed production cost sheet is 6 years old. I need 5 growers who would be willing to meet with me once or twice to help update information regarding cultural practices, equipment needs, and timing of operations. Please call me if you are able to help out (209) 488-3285.

USE OF ALFALFA LEAFCUTTING BEES IN SAN JOAQUIN VALLEY, CALIFORNIA 1991

Robbin W. Thorp
Entomology, University of California, Davis

The use of alfalfa leafcutting bees, Megachile rotundata, for pollination of alfalfa in the San Joaquin Valley of California in 1991 was highly successful. The bees emerged well, pollinated the crop efficiently in the vicinity of their domiciles, renested successfully, producing a second good emergence of adult bees. Only a small percent of bees emerged for the third cycle of adults and these renested successfully. Survival of immatures to adults from all bees renesting this year was high. There was little evidence of mortality due to parasitoids (Pteromalus), nest depredators (Tribolium spp.) or chalk brood (Ascosphaera agreggata) although all were present. However, the sampling methods I used were not designed to effectively measure mortality due to Pteromalus or Tribolium.

Much of the success was undoubtedly due to the unseasonably mild summer experienced throughout the valley in 1991. Temperatures only briefly exceeded 100°F for periods at the beginning of adult emergence, again in early July coinciding with the end of most first emergence nesting, and at the end of summer when most nesting had been completed. Very little effect of "pollen balls" or "unexplained mortality" was noted at the end of the season this year in contrast to reports from 1990. However, final figures will not be available until X-ray analyses and dissections are completed. The activity of the bees started later this year, the second emergence of adults was additionally delayed by the unusually mild summer temperatures, and very little third emergence was experienced. Most of the brood cells provisioned after the end of July produced overwintering larvae.

Since field temperatures did not reach high enough levels to contribute significantly to mortality this year, some controlled temperature studies were conducted in the laboratory at Davis with straws containing larvae of different stages of development. While these trials are not fully analyzed at this time, preliminary evaluations indicate that temperatures needed to be above 105°F and for prolonged periods of time to show detrimental effects and that later stages of development show less detrimental effects due to high temperatures.

Measures of tripping at different distances from alfalfa leafcutting bee domiciles showed about 80% or more tripped flowers within 30m (100 feet), dropping to about 40% between 40-53m (130-175 feet) in one data set and averaging 44.5% near a domicile versus 2.1% at 160m (530 feet). These figures for percent tripped flowers are confounded by the numbers of available flowers on a raceme. Measures of these show that flowers available for tripping at any time are about 5-6 near versus 12-15 flowers away from leafcutting bee domiciles. This reflects the rapid rate at which flowers are actively tripped and wilt near leafcutting bee domiciles versus the slow rate of turnover away from their influence.

However, data from racemes near and away from leafcutting bee domiciles and near and away from apiaries in bee drives without leafcutting bees did not produce consistent differences. Racemes were flagged at full bloom and collected a week or two later. Total flowers were estimated by presence of stipules, numbers of pods and seed set. Some inconsistency was due to Lygus damage, water stress due to heavy pollination, and time of season. Final yields in two fields in Kings County showed significantly higher seed production in strips with alfalfa leafcutting bees (M. Wadsworth, personal communication). These are supported by other comparisons made in Fresno County (S. Mueller, personal communication).

Evaluating Leafcutter Bees for Alfalfa Pollination in the Central San Joaquin Valley

Shannon Mueller, Farm Advisor, UC Cooperative Extension, Fresno County

Leafcutter bees have now been used successfully for the third year in the Central San Joaquin Valley. What began in 1989 with one seed grower and a single field grew to six cooperators and more than two thousand acres in 1991. Data has been collected each year in order to develop recommendations regarding management of seed fields and leafcutter bees for increased seed production.

Incubation proceeded without difficulty using several different grower-managed systems. Bees were incubated as loose cells or in nesting material with equal success. Incubating loose cells puts the bees on a more uniform cycle throughout the first generation - they emerge in a very short period and the population begins to decline fairly abruptly. When bees are incubated in either wood or polystyrene nesting material, there is a more gradual emergence of bees following incubation and the cycles between generations are more staggered. In order to avoid the distinct periods of activity and inactivity brought about by population cycling, growers might operate several incubators to stagger release dates and provide more opportunity to adjust to inclement Spring weather. For California, the loose cell system is recommended over a solid system due to the improved ability to control sanitation and prolong the period before Chalkbrood infests bee populations in this area.

Bees were released into seed fields beginning on May 7, 1991 and continuing through June 15. Planning to release bees when fields are in 35-50% bloom is recommended to provide adequate bloom at the time of emergence, more consistent and warmer temperatures, and fewer problems with third generation emergence late in the season.

Various shelter designs are being evaluated for Central Valley conditions. It is important that the shelter provide protection from direct sun, adequate ventilation to prevent the buildup of heat, and be of a size and mobility suitable to the individual grower's location. Due to the extreme susceptibility of these bees to pesticides, it is important that the bees be moved before pesticides are applied. The grower may choose to move the nesting material and leave the shelters in the field during a pesticide application, or the entire shelter may be moved.

In California, leafcutter bees typically complete a second generation and have a partial third generation. Research is being conducted to work out new management schemes to recover as many bees as possible in hopes of using them again in other areas or in subsequent years. Second generation bees were of higher quality than the bees that were originally purchased with an 80-90% live count in California compared to percentages in the NW of about 50%.

Leafcutter bees compliment honey bees in the pollination process and maximize pollination by working under different environmental conditions or working different parts of the plant. Based on the past two years experience, pollinating with 2 gallons of leafcutters per acre in combination with honey bees is recommended. Using this strategy, in 1991, growers saw yields increase by 225-300 lbs./acre over areas pollinated by honey bees alone. The estimated cost of pollination with leafcutters is being calculated for California, but $150-200/acre is commonly quoted in the Northwest. At that cost, the grower can easily pay for the cost of pollination with leafcutters, but must still ask whether the increased level of management that they require will fit into their farming system.

INFLUENCE OF FLORAL TRAITS ON ALFALFA SEED PRODUCTION

Larry R. Teuber, Associate Professor and Project Leader
Eric E. Knapp, GRA and W.L. Green, SRA - Project Personnel
Department of Agronomy and Range Science
University of California, Davis

Objective 1. Evaluate selection gain of easy to trip and hard to trip populations under greenhouse conditions (1991).

Progress - Data collection from greenhouse experiments to determine selection progress for ease of tripping has been completed. Data analysis is in progress. Preliminary analysis of 'CUF101' derived easy- and hard-to-trip populations, clearly shows these populations are different in ease of tripping. Analysis of 'Saranac' derived populations and comparison of actual and predicted progress will be complete by the end of 1991.

Objective 2. Continue studies to determine the effect of ease of tripping on the rate of selfing of alfalfa florets (1989-1992).

Progress - The second year of data collection is complete. Data analysis are proceeding. First year data show that altering ease-of-tripping has no influence on rate of self pollination. This is very exciting. We had been concerned that easy tripping would increase selfing. The increase in selfing would then result in reduced forage productivity of subsequent plantings.

Objective 3. Investigate how ease of tripping influences pollen dispersal (1990-1992).

Progress - All seed has been produced and analyses are proceeding.

Objective 4. Determine the inheritance of ease-of-tripping.

Progress - The second year of data has been collected to determine the inheritance of ease-of-tripping in CUF101. Data analysis is complete. Ease-of-tripping is controlled by both additive and nonadditive genetic variance. Additive genetic variance is substantially larger than nonadditive variance. Genotype X environment interactions were not significant. The latter results are in complete agreement with our earlier experiments (Crop Science, 1990, pages 270-275). The previous results demonstrated that environment had very little influence on ease-of-tripping and that any affect of environment was substantially less than genetic differences.

Objective 5. Conduct a comprehensive analysis of the aroma producing compounds (APC's) associated with the alfalfa flower, pollen, and nectar (1991-1992).

Progress - This study was established in the fall of 1991. Data collection will begin in the summer of 1992.

Objective 6. Complete determination of the genetic control of specific alfalfa floral APC's (1991).

Progress - Data collection for the second year of the floral volatiles inheritance study is proceeding. Samples stored at -70°C still need to be analyzed. We anticipate that these data will be complete by January 1992 and that data analysis will be complete by June 1992. This will permit development of genetically determined selection criteria for altering floral aroma to enhance honey bee activity.

Objective 7. Initiate studies to develop and evaluate germplasm with a floral aroma suited to visitation by honey bees (1991) (estimated completion of study 2000).

Progress - Seed of easy- and hard-to-trip populations was increased in isolation under honey bee pollination. We expect to submit data regarding the performance of these germplasm pools to the Germplasm Release Committee of the Department of Agronomy and Range Science by December 1991. These materials should be approved for release and available for distribution by June 1992. Seed to be used in floral aroma breeding populations was produced in 1991. Half-sib families representing this population will be established in the spring of 1992.

Objective 8.(new) Experiments to test honey bee response to combinations of aroma producing compounds have not been completed. These experiments were attempted in September and October 1991, but lack of honey bee activity prevented successful completion. The lack of activity probably can be attributed to a composite influence of the time of year and virus disease in the test honey bee colonies. We will repeat these experiments in the spring of 1992.

Research on the Lygus bug[1]

Objective 1. - A literature review of published information on the biology of Lygus bugs is in progress. This search has lead to one very encouraging set of information. That is research dating back several years which demonstrates the presence of a sex attractant produced by reproductively mature female Lygus bugs. This attractant is perceived by the antennae of male Lygus bugs. Our GC/EAD system can be used to further our knowledge of this sex attractant. We expect that the development of this new information will lead to the development of practical control measures for the Lygus bug that can be applied to alfalfa and all other susceptible crop species. A post-doctoral student (Ph.D. in Entomology) will be joining my laboratory in late November to work on this research. Continuation of this research will be dependent on maintaining and possibly increasing our existing funding.

Objective 2. - Prior to this past summer all screening studies using the "small cage" technique were conducted without any attempt to control factors such as Lygus age, Lygus sex, and flower age. The proper duration for alfalfa plants to be exposed to the Lygus bugs during screening also had not been addressed. Standardization studies were conducted at the Desert Agriculture Research Center (formerly the Imperial Valley Agriculture Research Center) for the small cage screening technique. These studies are complete and the data are being analyzed. Results will be used to refine the procedures used in screening using the "small cage" technique. I am still skeptical about the potential of the small cage technique for identifying alfalfa plants with tolerance to Lygus bugs. However, the refinements we will be making should increase the potential of the technique.

[1]This research was not funded by the ASPRB during 1991

Shannon Mueller

Seed Crop Notes is produced by
Shannon C. Mueller, Agronomy Farm Advisor