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UNIVERSITY OF CALIFORNIA
AGRICULTURAL EXTENSION SERVICE
PROGRESS REPORT

County of Tulare Date February 11, 1957 State Number 3038
County Number
Name of Project Improvement of Range Pasture Reported by Ralph L. Worrell

I. Procedure: During the last several years, progress has moved rapidly on a number of aspects of foothill range improvement in Tulare County. Work has been continued on two major factors: improvement of grassland and reclamation of brushland. In addition, during 1956, a new important phase was started on control of riparian vegetation for water conservation. Organizational work has continued with district, county, and regional range improvement associations.

II. Results: Progress on this project will be here described under each of the three major divisions as mentioned under Procedure.

A. Improvement of Grassland Range.

1. Fertilizer. Since the last progress report was written, a number of fertilizer demonstrations have been conducted demonstrating the effectiveness of sulfur materials in improving the stand and growth of range legumes, mostly burr clover. Results have been uniform on this type of fertilization since 1952, when the work was first initiated. Sack gypsum has been generally used due to ease of handling and leaving evidence of where it has been applied. Four hundred to 600 pounds of this high test gypsum per acre has been our standard recommendation. This application generally produces results for at least three years, following which another application usually produces results for another similar period. One rancher in the northern part of Tulare County has now fertilized the same area three times since 1952, with excellent results.

Beginning in 1955, fertilizer trials with a combination of nitrogen and sulfur have produced outstanding results on increasing growth of range grasses. Earlier trials using nitrate type nitrogen produced little if any results. Apparently, this was due to lack of available sulfur in the soil. Applications of ammonium sulfate at the rates of 300 to 600 pounds per acre have increased grass production several hundred per cent. Results in this regard have been uniform throughout the county. The heavier rates have usually been readily apparent compared to the lighter.

2. Re-seeding. Re-seeding foothill rangeland by broadcasting seed over the native cover has generally not proved successful. The only trial, to our knowledge, which is considered a success is one on the Keith Manley Ranch north of Elderwood where a special seed drill from the University was used in 1950. This drill scraped all of the litter from the soil surface in bands one foot wide. Seed was then drilled down the middle of each band. Observations through 1956 showed that harding grass and subclover have survived and

produced very well. Results indicate that this method of seeding may have possibilities on areas of favorable soil and moisture.

3. Tarweed Control: Tarweed has become one of the most serious problems on much of the grassland range in Tulare County. Grazing capacity has been greatly reduced and cattle show marked reluctance on moving into tarweed infested areas. During 1956, trials to reduce tarweed infestations were conducted on the Conlan, Manley, Brandt, Chrisman, Griswold, and Crooks ranches. In each case, ammonium sulfate was used at the rates of 300 and 600 pounds per acre, broadcast during the winter. The objective was to increase the growth of grasses to the extent that they would tend to smother out the young tarweed plants and also extract most or all of the surface moisture from the soil, thus making impossible the growth of tarweed during the summer.

On the Brandt ranch, the trial was a failure due to reasons which we do not understand. All of the other trials were outstanding successes. Growth of grass was markedly increased and tarweed reduced to a very low point. It had been hoped that results would be excellent for at least two years. However, on the location of the only tarweed control plot started in 1955 (on the Manley ranch, Eshom Valley) the influence of the ammonium sulfate was only slightly visible in 1956. There is considerable speculation whether applications of 600 pounds of ammonium sulfate per acre will prove feasible if they are only effective for one year. Further trials should be conducted in the future to obtain more information on this point.

On the Gilkey ranch in Drum Valley excellent control of tarweed occurred where there was a fair growth of burr clover in evidence. At our suggestion, the rancher broadcasted gypsum over the land. It has long been known that legumes in Tulare County respond to applications of sulfur materials such as gypsum. On the Gilkey ranch, the results of this trial proved outstanding. The burr clover in the fertilized area of approximately 14 acres grew so luxuriantly that it nearly obliterated the tarweed. These results have continued for three years from the one application. Since this offers the possibility of fertilizing with materials which do not assist tarweed, it is anticipated that further trials will be made in 1957 attempting to establish or encourage legumes on areas infested with tarweed. This same procedure may prove of value on areas covered with weedy grasses of low value.

4. Establishing perennial range plants: During the last several years trials have been conducted on the Manley, Gilkey, Griswold, and McCabe ranches on establishing perennial plants on land previously farmed. Results have been sufficiently promising to indicate that there are definite possibilities in retiring cultivated land to deep-rooted pasture plants. Such trials should be conducted and increased in the future. Species giving favorable results to date include burnet, alfalfa, harding grass, and tall fescue grass. Others should also be tried.

B. Foothill Water Conservation.

1. Conservation and development of water for stock, domestic, and irrigation use is a matter of major importance in the foothills

of Tulare County. Frequently, lack of water is the limiting factor to use, and improvement of range areas for grazing. It has long been observed that control of brush improves the water supply. To obtain further information on this important subject, cooperative studies were initiated with the Division of Irrigation in the fall of 1950. Two similar watersheds were selected in the Badger area. Detailed equipment was installed which would measure precipitation, water runoff, and erosion. As an adjunct to this, equipment was placed which would measure the interception of rainfall by brush. Areas 50 feet square were cleared of brush and soil moisture measurements made to compare differences of moisture on cleared areas versus brush areas.

After six years it was believed that sufficient comparison could be obtained of the two watersheds. Accordingly, during the summer of 1956, one of the watersheds was cleared of brush. The area was control burned and seeded to grass. Comparisons will now be maintained for several more years to determine the difference, if any, between water and soil flow from grass-covered watersheds as compared to one in brush cover.

2. Riparian vegetation control. In 1955, we began preliminary observations looking toward the possibility of improving foothill water supplies by the control of riparian vegetation along stream channels and around springs. It appeared there were potentialities of producing significant increases in water supply. After conversations with the Tulare County and State A.S.C. committees and consultation with representatives of the Federal A.S.C. committee, a special practice was developed and written into the A.S.C. handbook in Tulare County providing for financial assistance to ranchers who wish to control riparian vegetation.

After considerable investigation of possible sites, two locations were chosen for detailed studies on the influence on moisture supplies of riparian vegetation control. One was a wet weather spring on the H. & B. Cattle Ranch (Tom Martinez, superintendent) between Fountain Springs and California Hot Springs. The other was on the Cottonwood Creek channel below Auckland on the Cutler Ranch. The Division of Irrigation indicated their interest in this work and Professor Robert Burgy at Davis offered to assist us in outlining and developing this work.

Above and around the location of the spring there were 1 3/4 acres densely covered with trees. Most of these were blue and live oaks but there was one willow and four sycamores. Martinez and the Farm Advisor treated this area with 2,4-D amine using the cut surface method. Three and one-half hours were required for the two men to treat 177 trees averaging 18 inches in diameter. Two gallons of chemical were required. This work was done on August 23. Within ten days leaves on the willow and sycamore trees started turning color and dying. Within two weeks the spring which had heretofore been completely dry started to flow. For the balance of the late summer and fall the spring flowed at the rate of 300 gallons per day as measured by a meter installed in a pipeline leading from the spring.

The work on Cottonwood Creek near Auk land took considerable more time and effort. The creek channel was solidly covered with oaks, sycamores, willows, and other trees over an area averaging about 100 yards wide and 3/8 of a mile long. Measured on an aerial photograph there were approximately 17 acres involved. Professor Burgy and a crew from Davis, together with the Farm Advisor, constructed a small cement dam where a rock reef crossed the creek below the tree area. A metal weir was placed in this small dam. Recording apparatus was installed at this location. The rancher hired a crew to chainsaw the trees and spray the stumps to prevent re-sprouting. Also, the crew occasionally would do other types of ranch work so that completely accurate figures are not obtainable. It appears that the labor and material cost combined was more than $40 per acre. Records show that from a flow of practically zero, Cottonwood Creek increased to approximately 7,200 gallons per day going over the weir. This then indicated the moisture which was formerly being used by the riparian vegetation and which was saved by control of the trees.

These two trials demonstrate conclusively the great potentialities occurring for the development of foothill water supplies by control of riparian vegetation. It is contemplated that the work will be expanded during 1957. Careful measurement of aerial photographs of Tulare County indicated 9[illegible] miles of intermittent stream channels in the foothill area. A large portion of this length is covered with riparian vegetation to the extent that control of this unnecessary growth would greatly increase water supplies. In addition, there are probably hundreds of springs where riparian vegetation control would release much needed moisture supplies for stock.

C. Reclamation of Foothill Brushland.

1. Careful analysis of the foothill area of Tulare County has revealed that there are approximately 500,000 acres of brush and brush woodland. At least 50% of this area is so heavily covered with brush and unnecessary trees that grazing capacity has been greatly or completely restricted. Since 1946, considerable time and effort has been placed by the Extension Service in assisting foothill ranchers with methods of controlling brushland and reclaiming it to pasture. Results are already evident on the following: greatly increased carrying capacity for livestock; improved water supplies; reduced fire hazard to both crops and buildings; decreased cost of fire suppression; encouragement of game birds and animals through improvement of habitat. A reflection of the improved economic basis over much of this land is seen in the fact that assessed land values have increased and ranchers have stated that they are glad to be able to see this increased assessment because it indicates improvement in their property.

2. The Extension Service has maintained various educational programs to acquaint both the ranchers concerned and the public in general with the benefits of foothill brush control. Several series of colored slides have been prepared for use at meetings of Chamber of Commerce, Farm Bureau, Grange, Service Clubs, and other groups. Newspaper articles have been written and radio talks given on the various phases of the brush control program. The Farm Adviser participated in the development of a publication designed to acquaint the public with the benefits derived from the program. Rapid turnover of owners of foothill land in certain parts of the county has resulted in a continuing need for acquainting the new farmers with the needs, purposes, and objectives of the brush control program.

3. Tulare County was one of the first counties in California to develop a cooperative Range Improvement Association as a valuable means of implementing the Extension Service program. Originally, we developed four cooperative Range Improvement Committees in each of the major geographical districts of the county. Due to the fact that our foothills are not too heavily populated and also due to the fact that the general brush problem in the county is divided into northern and southern types, we suggested that the four district Associations be combined into two for ease and efficiency of operation. This was accomplished in 1956.

   The Tulare County Range Improvement Association comprises the two district Associations and includes all ranchers who are interested in brush control and other methods of range improvement. The Tulare County Association has joined with the other Associations in Central California to form the Central California Range Improvement Association. We have acted in an advisory capacity in counseling in the developing of district, county, and regional Associations.

4. Considerable effort has been spent developing improvement in organization and operation of control brush burns. In each of the two districts within Tulare County there are control burn committees. These committees have the responsibility of counseling with each rancher who is interested in brush control. The committee consists of the district officers together with the Farm Advisor and State Division of Forestry ranger. These district committees have been effectively developed to the point where they are competent to advise with ranchers on the practicability of brush control on the properties in question, appropriate methods to use in advanced preparation of the sites, time of year to conduct the burn, methods of burning, organization of the control burn itself, and conduct of the fire. The Farm Advisor has spent considerable time in further refining the development and functioning of the district committees and methods of conduct of the control burns. It is believed that this is at least a major factor in the very successful results which have been obtained in Tulare County with exceedingly low areas of escape burns. This

type of organization has resulted in whole-hearted cooperation between nearly all the foothill ranchers in the county.

5. Much progress has been obtained in the development of new ideas and methods for the advanced preparation for and conduct of control burns. When the program first started in 1946, attention was given only to the development of fire breaks. Later, as stated in the progress report of December 10, 1952, information had developed to the point where lanes were crushed through the brush using a bulldozer at intervals ranging from 30 to 60 feet apart to increase the effectiveness of the burns. Within the last three years information has further developed to the point where ranchers are urged to completely crush the brush on all areas which may be readily and safely covered by bulldozers. Results have more than justified this additional time and expense.

During 1955 and 1956 particular attention has been given to new and better methods of ignition and fire control for better results and greater safety. Area ignition has now become standard procedure on all control burns conducted during the spring and late fall and where possible on summer burns. New methods of starting procedure have been developed employing firing crews in such manner as to direct the fire toward the center of the burns and away from the control lines. New equipment for ignition and fire control, which has been given trial and demonstration in Tulare County, include electrical ignition using fuses on blasting wire and detonators; small fire bombs thrown by hand or slingshot into areas inaccessable by drip pots or flame throwers; distribution of fire bombs from airplanes and helicopter to assist starting the fire at the center of the burn; the use of diesel and butane flame throwers mounted on jeeps and pickups. All of these methods have shown definite application for certain conditions and situations.

Night burning in certain areas of higher hazard to broaden the fire lines has become an accepted practice.

Spraying of brush by airplane and helicopter several weeks prior to the burn in order to dry out the foliage and make a hotter fire has been tried. This is an expensive procedure but may have particular application in those areas where crushing by bulldozers is not feasible.

6. For several years studies have been carried on the merits and problems of out-of-season control burns in the spring and late fall. During 1956 there were five such burns conducted during the spring and five during the late fall. In each case, the results were very satisfactory. We visualize such out-of-season burns as being particularly desirable where the location is in a hazardous area such as adjacent to dwellings or other buildings

lines. The principal governing the success of such burns is that brush that is completely crushed by bulldozer will burn rapidly in the late spring and early fall when fire hazard is small. Crushed brush will burn with high intensity. However, when the fire burns to the edge of the standing brush, it will very quickly go out. In several cases in 1956, fires of great intensity, which had spread across crushed brush, moved only a few feet into the standing brush before going out completely. Trials have been made crushing brush at different intervals before burning. Sometimes a period of only three weeks after crushing has produced a satisfactory control burn. Generally, we recommend waiting at least one growing season between crushing and burning. This will permit sprouting of the brush to occur. The heat of the fire will then kill most of the sprouts, thus resulting in a longer period before a re-burn is necessary.

Studies are underway comparing effectiveness of spring and late fall control burns. Generally, in the spring the weather conditions are more favorable and can be planned on with reasonable certainty. However, late fall burns have usually resulted in greater control of the brush with far less sprouting the next year. Also, the ash is still remaining upon the ground at the time of seeding and thus offers a favorable enviornment for the seed to sprout. If brush is burned in the spring, the ash is nearly always removed by wind before seed is planted in the fall.

It is anticipated that out-of-season burns will continue to be held, primarily in areas of high hazard or in locations of moderate size, probably not over 250 acres in extent. A further use of this technique appears possible in creating wide fire breaks for fire suppression adjacent to National Park or U. S. Forest Service boundary lines. These burns may in turn permit control burns in adjoining areas during the summer.

7. Study has been given for several years to the problem of seedlings and re-growth following control burns. If fire alone is to be utilized as the brush reduction method, information developed in Tulare County indicates that a re-burn should be considered preferably the second year after the initial burn and at least probably not later than the third year. If this first re-burn is successful, it appears that a second re-burn will not be required for at least five or six years. From then on, probably a re-burn every six to ten years will be sufficient.

A number of trials have been made in the county using chemical materials for the control of brush re-growth and seedlings after a control burn. It now appears that this may be a practical method of eliminating most of the re-growth and seedlings for a number of years. The additional cost of the chemicals as compared to re-burning may be largely compensated for in the saving of grass for livestock which would otherwise be required for carrying the re-burn.

Studies in several areas of the county have indicated the chemical control of the original standing brush probably is not feasible. Generally, the brush is of such height and density that control has not been satisfactory. One exception to this has been on the Elliott place in northern Tulare County where white thorn has been completely killed by one application of chemical. However, other brush species have not been controlled in the same area and seldom does white thorn constitute over 30% of the brush cover.

On the Manley ranch in Eshom Valley attention has been given during 1956 to the control of brush re-growth after a control burn by spot spraying with ground equipment. The possibilities of this are interesting and offer some promise for the future.

8. Observations have shown conclusively that grazing practices have a great influence on the degree of brush re-infestation after a control burn. It appears that generally the best grazing practice is to turn the cattle into the field rather early in the first growing season after the control burn and permit the cattle to graze the annual grasses which may occur and early brush re-grweth. Then, the cattle should be removed to permit the perennial re-seeded species to produce growth and mature seed. Later in the summer the cattle can be permitted to re-enter the field and graze the perennials moderately. In successive years approximately the same practice may be followed except that the perennials may be grazed more closely than in the first year when it is essential to develop a sturdy plant and good root system. Graphic illustrations of this type of grazing practice are evident in several areas of the county.

9. Because the primary purpose of brush land reclamation is to obtain pasture for livestock, more time and attention has been given to the various factors involved in re-seeding control burns and obtaining permanent grass cover than to any other aspect of the problem. A wide variety of trials and demonstrations on different phases of re-seeding have been tried throughout the county at different elevations. These are summarized here under their respective headings:

a. Species: The brush area of Tulare County includes a wide variety of soils, slopes and exposures from 1,500 feet up to 4,000 elevation. A large number of tests and demonstrations have been required in order to obtain information which could be used for the basis of recommendations for ranchers. We have found however, that responses have been remarkably uniform throughout the county. As a result of these trials, the species have been divided into three groups: excellent, good, and fair.

Excellent: Harding grass, tall fescue grass, burnet, alfalfa, and domestic ryegrass.

Good: Orchard grass, intermediate wheatgrass, mountain bromegrass, yellow sweet clover, perennial ryegrass, rose clover, burr clover, and prairie bromegrass.

Fair: Tall meadow oatgrass, bridsfoot trefoil, smilo, subclover, crimson clover, harlan bromegrass, and big bluegrass.

We have found the responses of these plants to be rather consistent wherever they were planted on areas where the soils were fairly deep and moisture was favorable. On the western and southern exposures at lower elevations, where summer moisture is a limiting factor, we have usually recommended the use of annual plants, principally domestic ryegrass and rose clover.

A basic perennial seed formula which has found wide acceptance and given good results has consisted of:

tall fescue grass	2 lbs. per acre
harding grass	2 lbs. per acre
domestic ryegrass	1 lb. per acre
burnet	2 lbs. per acre
alfalfa	1 lb. per acre

Frequently, ranchers have individual preferences, obtained perhaps by results on their own properties, and in place of the basic mixture have used one or more other plants. The most popular species substituted in this mixture have been orchard grass, mountain bromegrass, and intermediate wheatgrass. Harding grass is the best all-around plant. Although it starts slow, each year it becomes better.

b. Rates: Observations have indicated that it is necessary to seed higher rates from aircraft than from the ground. When broadcast by airplane or helicopter at least eight pounds per acre is necessary and some ranchers feel that ten pounds is advisable. When seeded from the ground, on foot or on horseback, the rate can be reduced to six or seven pounds per acre. This is permitted by less wastage of seed on unfavorable sites.

c. Time: During the early years of the control burn program, it was felt that seed should be broadcast immediately after the control burn and preferably while the ashes were still hot. For a number of reasons this was frequently not possible to do and as a consequence we found it is unnecessary to apply the seed so soon. Present recommendations are that seed should be applied in the middle fall just prior to the time that early rains are anticipated. The combination of warm weather and early rains are conducive to good stand and growth. Fall seeding also minimizes loss from birds, ants, and rodents.

d. Ground seeding: Results from ground seeding have been superior to aircraft application. As a consequence, during the last two years on all but the largest control burns or except on areas difficult to travel, seeding has been done from the ground by walking or on horseback. One burn was seeded by broadcaster pulled by crawler tractor. Results have shown that a man using a small crank seeder can seed at least twenty to forty acres in a day's time. On horseback, sixty to eighty acres have been seeded per day.

During the fall of 1956, control burned acreage on the Keith Manley ranch in Eshom Valley was seeded with a special high clearance stump-jump drill provided by Range Management Investigation at Davis. This was on the University experimental range. Results from drilling seed by this method have been outstanding. Mr. Manley has stated that in the future he would like to drill all the control burn areas possible. During 1956, drilled seed provided a quicker germination and better growth following the few fall rains with far less damage due to frost heaving. In addition, the seed was covered so that loss due to birds, ants, and rodents was considerably reduced. Drilled seed stayed in moist soil and kept growing, whereas broadcast seed dried out so fast after the short rains that much of it never sprouted until after January 1, 1957.

e. Effect of covering: Indications were obtained during the fall of 1956 on several areas that covering seed broadcast after a control burn should be beneficial. It appeared to improve germination and early growth and certainly reduce damage due to frost heaving and birds and ants. This aspect of the seeding problem should be investigated further in 1957.

f. Frost heaving: Damage due to frost heaving has nearly always been considerable at the higher elevation of control brush burns. This is particularly true when the rains come late and there is not much growth before cold weather occurs in the winter. Generally, we have found legumes and burnet to be less susceptible to heaving than the grasses. Also, as mentioned above, when the seed was covered either by drilling or using drag equipment the amount of damage from heaving was greatly reduced.

g. Loss of seed: Large numbers of birds, ants, and rodents occur in the foothills of Tulare County. It is to be expected, therefore, that when seed is broadcast considerable loss can be expected unless the seed is covered or germination occurs quickly from fall rains. In 1954 following a control burn in Eshom Valley, tests showed that coloring the seed greatly reduced loss from birds and ants. However, this method has been used very little by ranchers. It is possible that greater attention should be given to this factor in the future.

h. Effect of subsequent control measures: During the early days of control brush burns, one of the reasons advanced by ranchers for not seeding perennials was that the future brush re-growth control measures such as fire or chemicals would damage the perennials to the extent that it was not feasible to seed them.

Observations in several areas of Tulare County have indicated very little permanent damage to perennials from such re-growth control measures. Accordingly, we feel that this is not an important factor when compared to the advantage in obtaining a stand of perennial forage plants after the initial burn.

10. Increased water flow after brush control: For many years ranchers have observed increased flow of water from springs and streams as a result of brush control measures from either wild fires or control burns. It has not been feasible in Tulare County to set up a definite study on this influence on water supply where control brush burns were to be conducted. However, in 1950 a pair of watershed studies were developed with the assistance of the Division of Irrigation. This work is reported in more detail under "Water Conservation by Control of Riparian Vegetation." These studies are located centrally near Badger where much of the brush reclamation work is underway and results should be typical of at least that part of Tulare County. In nearly every case, water sheds which are reclaimed from brush and planted to grass produce water further throughout the summer dry season than do adjoining watersheds brush covered.

The Farm Advisor has a number of colored slides showing new springs which have developed after control burns where a water supply was not known to occur before.

11. In 1950, the University of California Field Station Administration selected a protion of the Keith Manley ranch in Eshom Valley as a Range Demonstration Project. Since that time, Mr. Manley has cooperated wholeheartedly with the Agricultural Extension Service and Field Station Administration in the development of tests and demonstrations on many phases of brush range improvement. During the last two years additional land has been added to the original 400 acres under study so that now nearly 2,000 acres are included. There is also an area of irrigated pasture where trials are being conducted adjacent to the range land.

Many of the presently accepted brush reclamation practices being used in Tulare County were early tried and developed on the Manley ranch, including such important phases as extent of brush crushing, desirable methods of applying seeds, variety trials, chemical control of re-growth, use of a seed drill, and a number of trials of ignition and control of fire. Most of the expense of trying new materials and methods are born by the Field Station Administration. The Farm Advisor enters fully into the planning and conducting of the trials. Several tours have been held on the property to demonstrate results of the work underway.

12. Cooperative relationships with other agencies in order to bring to bear all the information possible on brushland reclamation practices has resulted in wholehearted cooperation from a number of governmental agencies. Several of our trials and demonstrations have been conducted cooperatively with one or more of these agencies. These include the U. S. Forest Service, National Park Service, Bureau of Land Management, Agricultural Conservation Program Service, California Division of Forestry, and California Department of Fish and Game. Also cooperating have been several county agencies as well as the Farm Bureau and Grange.

III. Conclusions: Although much progress has been made in range improvement in Tulare County, it is truly said that for every question which is answered there are two more which appear. With the increased emphasis which is being given range improvement, it appears desirable to divide the work into two more projects. Accordingly, it is planned to write new projects for "Reclamation of Foothill Brushland to Pasture," and "Conservation of Foothill Water Supplies by Riparian Vegetation Control."

IV. Signature:

Ralph L. Vlasnell
Farm Advisor

Feb. 25, 1957
Date

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS
U. S. DEPARTMENT OF AGRICULTURE AND THE UNIVERSITY OF CALIFORNIA COOPERATING

Progress Report

Tulare County

Name of Project Improvement of Range Pasture

PROJECT NUMBER: State 3038 County 71

REPORT PREPARED BY Ralph L. Worrell
Farm Advisor

DATE May 28, 1957

Are project and progress reports to continue? Yes x No

I. PROCEDURE USED: The project addition of November 1, 1956, listed four major objectives for this project during the winter and spring period, 1956-57. There were: fertilizer, reseeding, tarweed control, seeding perennial forage species on cultivated land.

II. RESULTS: A. Fertilizer: Two replicated fertilizer trials were established by the Farm Advisor on the John Guthrie and Keith Manley (Dixie) ranches this year and assistance was provided in another replicated fertilizer trial on the Manley Eshom Valley ranch in cooperation with Field Station Administration. Complete results from the Eshom Valley trial have not yet been tabulated but it is evident that the combination of nitrogen plus sulfur resulted in the greatest growth responses on native range grasses. In each case the fertilizer applications in February out-yielded those made in October. It is presumed that this was due to some leaching of the material applied in the fall. The fertilizer test on the Manley (Dixie) ranch was not harvested for yield determination. Two meetings were held at this test, however, to demonstrate the results. Nitrogen produced little difference in growth response. When sulfur was added to the nitrogen, considerable increase in production was evidenced. It appeared that this year 250 pounds per acre of ammonium sulphate produced approximately the same results as 375 pounds per acre. It is recognized that there may be some difference in carryover next year. Both 50 and 100 pounds of sulfur per acre in the form of gypsum encouraged considerable stimulation in growth of range legumes. This first year there was little difference evident between the two levels of application. Observation trials were also conducted on the Gilkey Farms in Drum Valley and observations continued on the Donlan ranch near Badger. Both of these applications were established by the ranchers after viewing Extension fertilizer trials the year previously. Due to the fact that exact rates of application were not available, yields were not obtained on either trial. On the Gilkey Farms, the rancher estimated ten times the production of forage per acre from 200 pounds of ammonium sulphate

III. CONCLUSIONS: A. In most areas of Tulare County, range grasses show marked stimulation to a fertilizer combination of nitrogen and sulfur. There is some evidence of this causing a change in plant species composition.

B. This same result affords one possibility of tarweed control through increasing both growth and palatibility of grasses. Heavy early grazing for at least two years might eliminate much of the tarweed problem.

C. Drilling of perennial plants in native cover on deep soil at elevations over 800 ft. shows some promise. Elimination of annual competing grasses is necessary, either in narrow strips or by properly cultivating larger areas. Developing a forage composition containing considerable quantities of annual legumes seems possible by reseeding and then fertilizing with sulfur or gypsum.

SIGNATURE: Robert L. Worrell
Farm Advisor

Make sufficient copies of this report to supply one to each signer of the project or project addition.

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II. Results cont.: broadcast in January. In addition, he estimated that feed had reached a grazing height of eight inches approximately six weeks earlier than the unfertilized areas. During this interval he was feeding his cattle in the valley at apporximately $4.00 per head per month. On the Donlan ranch the owner likewise estimated a ten fold increase in forage and eight weeks earlier grazin start. In addition, he estimated the feed in the fertilized areas to be at least 95% filaree whereas in the unfertilized areas he estimated the forage to be at least 80% tarweed and foxtail grass. It appears that this might indicate a change in forage composition.

B. Reseeding: Reseeding trials were planned to obtain information on two points: 1) establishing perennials on areas of deep soil and favorable moisture and, 2) encouraging stands of annual legumes on areas of weeds or weedy grasses.

On the first point trials were established on the Cutler estate, Manley (Dixie) ranch and Gilkey Farms, drilling seed into the soil by the stump-jump drill developed by Field Station Administration for use on control brush burns. It was acknowledged that this was not the ideal type of equipment for use on land supporting native range cover but it was thought some indication might be obtained as to the value of seed drilling. A variety of grasses and legumes were tried. Due to the fact that there was no fall rain of consequence, it was not possible to obtain an early stand and growth of harding grass, tall fescue grass, and burnett have been obtained in several locations on each of the ranches. It is uncertain whether these plants will be able to survive the dry summer with such a late start in growth. It is felt that this method of drilling perennial species into an annual range cover would have distinct possibilities with some change in the equipment used. We feel that a knife blade or disc openers should be placed on the front of the drill to reduce the surface cover on strips perhaps a foot wide. This would eliminate much of the competition the first year from the weedy annual growing species. The seed could then be drilled down the middle of each of these strips with fertilizer being pressed an inch or two under the seed. Such strips probably should be placed from thirty to thirty six inches apart. The ranchers on whose property the work was conducted this year have indicated their interest in

III. Conclusions cont.: D. Retiring foothill cultiv[illegible] land to perennial forage species appears feasible. Seed should preferably be drilled. Fertilization probably should be postponed to the second year.

(Copies of the Fertilization Trial attached)