

Northern Arizona Beef Production Is Affected By Pinyon-Juniper



CHAINING LARGE JUNIPERS near Cibecue, on the Whiteriver Apache Indian Reservation in northern Arizona. Here two large diesel tractors are attached to a heavy chain and, as the tractors move parallel, about 40 yards apart, the loop of chain tips over the trees. A return reverse trip over the same area completely uproots trees not entirely downed on the first chaining. Photo taken during Bureau of Indian Affairs range improvement field trip in June 1962.

M. L. Cotner

and

M. M. Kelso

Pinyon-juniper control is an important problem facing ranchers in northern Arizona and the Southwest. To find out more about this problem we surveyed 189 northern Arizona beef producers in the pinyon-juniper area. Here is what we found:

Pinyon-Juniper Problems

Practically all ranchers interviewed considered pinyon-juniper a serious range problem. On cow-yearling operations, we found that the sale weights and the number of animals sold per 100 cows decreased as the proportion of pinyon-juniper on the ranch increased. A look at our table will make this clear.

Ranches with less than a third of their area classified as pinyon-juniper averaged over seven yearlings more per 100 cows than ranches with two-thirds or more of their area in pinyon-juniper. Likewise, the yearlings averaged 18 pounds heavier on the ranches with less than one-third of the land in pinyon-juniper.

Not only were the selling percentages and sales weights higher, but the stocking rates were higher when there was less pinyon-juniper. Ranches with less than a

third pinyon-juniper land were stocked at the rate of 7.5 animal unit years (AUY's) per section which was 0.6 of a unit higher than the more heavily infested group.

Presumably the reduction of competition in forage production provides improved range feed for the livestock, thereby allowing higher stocking rates and yearling weights. Higher selling percentages apparently result from improved herd management through more accessible rangeland and better nutrition because of the improved forage.

Brushland Requires More Labor

Labor hired was approximately one-tenth of a month per section less on the ranches with under one-third of their area in pinyon-juniper than on ranches with over two-thirds of the area infested. In personal interviews, ranchers reported that less spring and fall round-up labor and other herd management labor is required when the range is free of pinyon-juniper.

If we assume that a "cow home" for the brood cow, her current calf and her

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The authors are Agricultural Economist, Farm Economics Division, Economic Research Service, United States Department of Agriculture, and Professor of Agricultural Economics, University of Arizona, respectively.

yearling held for fall sale represents two AUY's, then the salable beef produced per section on the average ranch with less than one-third of its area infested with pinyon-juniper is 1,648 pounds: 7.5 AUY's/2 = 3.75 cow homes × 72.8 per cent yearlings produced per cow × 604 pound sale weight = 1,648 pounds. On the other hand, the ranch with more than two-thirds of its area infested with pinyon-juniper produces 1,320 pounds of salable beef per section: 6.9 AUY's/2 = 3.45 cow homes × 65.3 per cent yearlings produced per cow × 586 pound sale weight = 1,320 pounds.

The difference of 328 pounds of salable beef represents the average added gross production per section on lightly infested ranches as compared with those heavily infested. In addition, one-tenth of a month or about three days of hired labor can be saved per section.

Adds Up to \$112 Per Section

If yearlings sell for 25 cents per pound and hired labor is paid \$10 per day, the change in ranch returns per section is \$112.00: 328 pounds × 25 cents price = \$82.00 + 3 days labor saved × \$10.00 wage rate = \$30.00 for a total of \$112.00. The change in returns would average about 18 cents per acre per year. The return per acre would actually be somewhat less than this because of the additional ranch production costs associated with the increase in stocking rate. Nevertheless, the implications are that, given the price assumptions stated, these lands will average 15 cents to 20 cents additional benefits per acre per year when the pinyon-juniper competition is reduced from a heavy to a light infestation.

In deciding about pinyon-juniper removal and control, each rancher must weigh the expected benefits against the costs of control and the expected maintenance costs under the conditions of his ranch. Each ranch situation will probably differ from the average conditions reported here.

Pinyon-juniper removal allows native grasses to revegetate naturally. This process takes time, which may delay the receipt of the added benefits until several years after the removal expenditure has been made. The recovery rate will vary depending upon the range site and its condition.

On the other hand, if pinyon-juniper is increasing in density or is invading new land, pinyon-juniper removal now may guard against future forage losses. Each rancher must consider all of these factors when making economic decisions about pinyon-juniper removal and control on his land.

Effect of Pinyon-Juniper Infestation on Stocking Rates, Production Rates, and Labor Hired on Brood Cow Ranches, Northern Arizona Pinyon-Juniper Woodland Type¹

<i>Pinyon-juniper infestation² (per cent of ranch area)</i>	<i>Stocking rate AUY's per section</i>	<i>Salable yearlings produced³ No. per 100 cows</i>	<i>Yearling weights Pounds per animal</i>	<i>Labor hired Months per section</i>
Less than 33 - -	7.5	72.8	604	0.24
33-66 - - - -	7.2	70.2	603	0.21
67-100 - - - -	6.9	65.3	586	0.34
Weighted average	7.1	70.0	597	0.33

¹Based on 86 cow yearling operations represented in the 189 mail reports of ranch operators listing pinyon-juniper woodland on their holdings. These data developed from unpublished results of a mail questionnaire sent to all ranchers in Arizona in January 1958, by the Department of Agricultural Economics, University of Arizona and the Farm Economics Division, Economic Research Service, United States Department of Agriculture. Of the reports of ranchers in the pinyon-juniper type, an examination of the second and third mailings showed no consistent trend in size and type of ranches reported.

²Includes minor acreages of other brush and timber types.

³Heifers for replacement are not included.

Must Figure Expected Return

Let us assume that a rancher on an average kind of site decides that, by reducing the infestation of pinyon-juniper and giving the range time to recover fully, he will add 18 cents per acre per year to his net income (after changes in ranch production costs are deducted). He can capitalize this annuity into a present value for the pinyon-juniper improvement which, from a dollar and cents standpoint, represents the maximum amount a rancher would want to spend on juniper removal and on future maintenance costs.

If 5 per cent is the appropriate capitalization rate,¹ an 18 cent annuity would capitalize to \$3.60 per acre: 18 cents ÷ by .05 = \$3.60. But the rancher does not obtain the 18 cent benefit rate immediately. At best only a fraction of this is available the first year, and the amount available increases each following year as the range gradually recovers.

Research by range scientists indicates that the full potential of the range may not be reached for eight to 10 years.² Additional economic research by the authors indicates that the capitalized value of \$3.60 should be adjusted down-

¹The "appropriate capitalization rate" is simply the rate of interest return the rancher feels he must get on funds invested in his ranch real estate. This may be the rate he would have to pay on borrowed funds for this purpose or that he could earn on the funds were he to invest them in the next best alternative available to him.

²See the report by Arnold, Josef F., and W. L. Schroeder, "Juniper Control Increases Forage Production on the Fort Apache Indian Reservation." Rocky Mountain Forest and Range Experiment Station Paper No. 18, December 1955, Figure 6, p. 31.

ward to \$1.99 to allow for the delay in reaching the full benefit of 18 cents (which it is assumed will not be reached until the ninth year). The adjusted figure also allows a credit for future productivity saved by controlling pinyon-juniper now and not allowing the range site to deteriorate further.

If the rancher feels that 3 per cent is the appropriate capitalization rate (instead of 5 per cent) then the adjusted capitalized value would be \$3.89. For a 7 per cent rate, the comparable value would be \$1.19. In these examples, based on the average conditions of reducing juniper infestations from more than two-thirds of the ranch area to less than one-third of its area, the allowable costs for making the improvement range from \$1.19 to \$3.89 per acre.

This Includes Everything

The adjusted capitalized values in effect represent the allowable cost for all the practices necessary to achieve the 18 cent added benefit. These involve the initial pinyon-juniper control cost, a sinking-fund for periodic maintenance costs, and other current costs such as special fencing or water development that might be necessary to actually utilize the increased forage production. For instance, if a 45 cent maintenance expenditure is expected every 22 years³ then at the 5 per cent capitalization rate a fund of 24 cents could be set aside to accumulate interest and provide for all future maintenance costs. In the previous example, the 5 per

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³Research by the authors indicate that for medium potential sites and their corresponding loss of productivity over time, "hand chopping" maintenance operations at 22-year intervals would be optimum.

TRISTEZA DISCOVERED IN TANGERINES IN ARIZONA

Ross M. Allen and Herbert H. McDonald

Until October, 1962, Tristeza or "Quick Decline" virus disease of citrus was thought to be restricted in Arizona to the noncommercial variety of citrus called Meyer or Chinese lemon. Results of a state-wide virus survey, however, show this dangerous disease to be present in Clementine (Algerian) tangerine trees at the Yuma and Tempe Citrus Experiment Stations.

The first discovery of tristeza in Clementine tangerines (for which the commercial name is Algerian tangerine) in Arizona involved three trees on rough lemon roots which had been imported from California for planting at the Yuma Citrus Experiment Station about 1927.

These three trees, possibly infected when planted, have declined since 1950, with gradual reduction of vigor and yield. Subsequent virus indexing tests have revealed four additional cases of tristeza-infected tangerines at the Yuma Station and two have been found at the Tempe Citrus Experiment Station.

All six of the newly-found diseased trees apparently were grown from infected buds taken from the imported trees during the years 1946 to 1950. These recent propagations of diseased material are the cause of considerable

concern, since records indicate that most of the Clementine tangerines in Arizona are bud descendents of trees located on the Yuma Station. It is, therefore, entirely possible that numerous diseased tangerines have been distributed unknowingly throughout the citrus areas of Arizona.

Rootstock is a Prime Factor

When sweet oranges, grapefruit, tangerines, tangelos, or limes are grown on Rough lemon, Troyer citrange, or Cleopatra mandarin roots, they are much more tolerant of tristeza than when these same varieties are grown on sour orange rootstock. Lemons are generally tolerant of the virus.

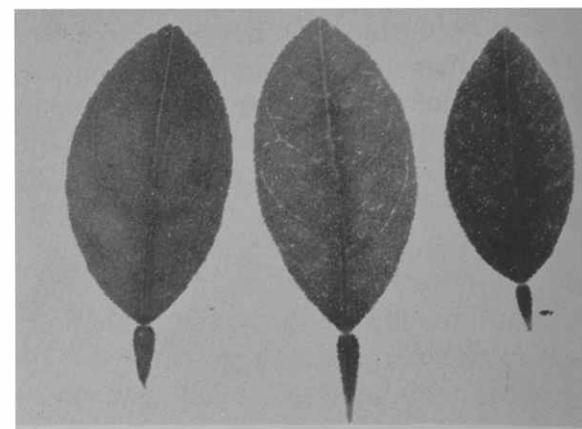
These circumstances cause the presence of tristeza in Arizona to be of considerable concern to the citrus industry in the Salt River Valley. Approximately 95 per cent of citrus grown in that area is on the susceptible sour orange root. In the Yuma area nearly all of the trees are being grown on the tristeza-tolerant Rough lemon root.

Although the immediate potential danger possibly is greater for the Salt River Valley area it must be noted that all commercial citrus varieties may serve as virus reservoirs, regardless of the root-scion combination. In Florida, several strains of tristeza virus have been recognized on the basis of severity of injury to susceptible varieties. New strains can be developed through mutation. Some newly developed strains may even be capable of causing severe decline of citrus on roots which are now presumed to be tolerant.

Narrows Choice of Rootstock

In any event, the presence of tristeza will have the effect of restricting the

The authors are associate plant pathologist and assistant in research, respectively, at The University of Arizona Citrus Experiment Station, Yuma. Photos accompanying this article were taken by Mr. McDonald.



TRISTEZA VEIN-CLEARING symptoms are shown in the two leaves of a Mexican lime, at right, after inoculation from Clementine tangerine. The healthy leaf, at left, is for comparison.

choice of rootstocks to those currently tolerant of the disease. Some of these may be undesirable for other reasons, such as susceptibility to diseases other than tristeza, lack of adaptability in a particular locality, or fruit yields of inferior quality or quantity.

Insect Spread Is Possible

The presence of tristeza in a commercial variety cannot be regarded lightly. Tristeza is one of the few citrus viruses known to be transmitted from tree to tree by aphids. One of the insect vectors, or virus carriers, is the cotton or melon aphid (*Aphis gossypii* Glover), which is commonly found in all Arizona citrus areas. These aphids may be especially numerous where black mustard (*Brassica nigra* (L.) Koch) occurs as a common weed. Although *Aphis gossypii* is known to be an inefficient carrier of the virus causing tristeza it has been responsible for transmission of the disease in California and Florida.

No Evidence of Spread

At present, there is no evidence that insect transmission of tristeza has occurred in Arizona. However, a note of caution must be emphasized regarding this point. Many reports of first recognition of tristeza in other parts of the world have included statements that indications of insect spread were lacking.

Continued study eventually showed that insect transmission actually was occurring in most locations. Many additional indexing tests will be required before satisfactory conclusions can be made regarding this possibility in Arizona.

Prevent Inoculum Sources

Increase of inoculum sources of tristeza in Arizona groves must be prevented. In California, where tristeza (better known as Quick Decline) is still causing losses of thousands of trees each year, insect spread was enhanced by inadvertent establishment of numerous bud-propagat-

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cent capitalized value of \$1.99, reduced 24 cents for all future maintenance costs, leaves \$1.75 per acre for the initial pinyon-juniper control costs and other special costs if necessary.

Allows for Variables

Obviously, the capitalized value, hence allowable costs, will vary not only with the capitalization rate but with the productivity of each site and the pertinent recovery rates over time. The example here, based on the average productivity relationships in the pinyon-juniper type shown in the table, indicates that large per acre control costs may be questionable, especially on sites with below average potential.

The subject of the economics of pinyon-juniper removal and control will be treated more fully in forthcoming bulletins and releases of the Arizona Agricultural Experiment Station.