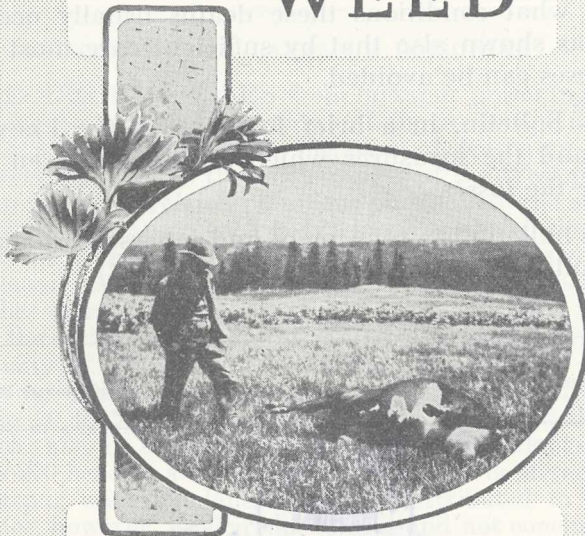


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U. S. DEPARTMENT OF
AGRICULTURE
FARMERS' BULLETIN No. 988

LARKSPUR
or POISON
WEED



2639



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FARMERS' BULLETIN No. 588

LARKSPUR

STOCKMEN who graze cattle on the mountain ranges of the western part of the United States often suffer heavy losses from larkspur poisoning. Careful and long-continued investigation has shown under what conditions these deaths usually occur and has shown also that by sufficient care most of the losses can be avoided.

This bulletin, in a brief form, gives the known facts and the measures which should be taken to reduce the losses.

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LARKSPUR OR "POISON WEED"

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LOSSES FROM LARKSPUR POISONING

THE RECORDED LOSSES from larkspur poisoning have been very largely in the cattle ranges of the western United States and Canada, although many instances of poisoning are known in the Eastern States. In the cattle ranges of the West probably no other group of closely related poisonous plants, with the exception of the loco weeds, has caused such heavy losses to the stockmen.

It is difficult to determine with any degree of accuracy the extent of these losses. A conservative estimate based on reports from a large number of ranges indicates that the annual loss is from 3 to 5 percent of the cattle grazing on the ranges where the larkspurs grow. A great many of the stockmen who have reported on the subject have given an estimate of 5 percent. Specific cases are known in which from 20 to 50 cattle out of a single herd have died within a few hours, and in other instances individual stockmen have lost as many as 200 head in a season. As these losses occurred on ranges where larkspur was abundant, they were attributed to this plant. The evidence, however, was circumstantial and not conclusive proof. Definite evidence of the toxicity of several species of larkspur was obtained by the experimental work done by the United States Department of Agriculture previous to 1916. Reports of losses have come from practically all the cattle ranges in the mountains from the Rocky Mountains westward. These ranges at the present time are very largely in the domain of the national forests, and a map of the national forests of the region would give a fair idea of the distribution of most of the larkspur poisoning. Some losses, also, have occurred in the Plains area and in the Eastern States.

¹This revision is by A. B. Clawson. C. Dwight Marsh retired September 1930.

LARKSPURS POISONING LIVESTOCK IN THE UNITED STATES

Two general groups of larkspurs are found on the western ranges—the tall and the low larkspurs. The tall larkspurs, of which there are several species, grow in great abundance in the gulches and canyons and on the moist hillsides of the more elevated ranges, while the different species of the low larkspurs grow on the open hills and flats, in drier localities, and extend to somewhat lower altitudes.

In the regions where the plants are abundant they are commonly known as “poison”, “poison weed”, “cow poison”, and sometimes



FIGURE 1.—Tall larkspur (*Delphinium barbeyi* Huth) before blossoming. This is the most dangerous stage of the plant.

as “bluebell.” In New Mexico the tall larkspurs are known as “peco.”

TALL LARKSPUR

Delphinium barbeyi Huth (fig. 1), which may be taken as a type of the tall larkspur, is found in the mountains of Colorado, Utah, Wyoming, and Idaho. It grows from an altitude of about 8,000 feet to very near the timber line and has caused the death of many cattle. When fully grown it is from 3 to 7 feet in height, with a long, woody root, and has violet-blue flowers. The plant begins growth early in the spring, shortly after the snow has melted. In the locality of the experiment station at Mount Carbon, Colo., it was from

1 to 2 feet high in May, forming bunches much more prominent than the grass. Near the Salina Experiment Station in Utah, it does not start growth until June or later, depending on the disappearance of the snow. Figure 1 shows the plant as it appears before blossoming. It blossoms in July or later, and the seeds are formed in August or September, when it commences to dry up, but it does not entirely disappear until broken down by the winter snows. The growth and development of the plant vary greatly and are dependent on altitude, slope, and the disappearance of the snow. Especially at the higher altitudes, many plants are blighted and never develop fruit. Some never form flowers or flower buds. The leaves of such plants lose their poisonous properties more slowly than do those that develop normally.

The common species found in Montana is *Delphinium occidentale* S. Wats. It occurs also in Idaho, Wyoming, and Utah. Figure 2 shows the form of the leaf, flower, and seed pod of this species. In its general appearance and habits of growth it closely resembles *D. barbeyi*. In the vicinity of the Salina Experiment Station the two species are often found growing together.



FIGURE 2.—Tall larkspur (*Delphinium occidentale* S. Wats.)

In the field they can be distinguished, especially in the older stages of growth, by the following characteristics: The larger stems of *D. barbeyi* are dark green; those of *D. occidentale* have a slightly grayish or powdery appearance. On the upper and finer stems of the *D. barbeyi* the hairs stand erect and have a yellowish cast; on those of *D. occidentale* the hairs lie close to the stem. When in fruit the plants are even more readily distinguished, as the pods of *D. barbeyi* are smooth and have purplish areas, whereas those of *D. occidentale* are covered with fine hairs that lie close to the pod. In the other mountain ranges of the West the species of tall larkspur resemble very closely the two mentioned.

Among the other tall larkspurs that poison cattle in the western part of the United States are: *D. glaucum* S. Wats., of western Nevada, California, and Oregon; *D. trolliifolium* Gray, of northern California, Oregon, and Washington; and *D. robustum* Rydb., of Colorado and New Mexico.

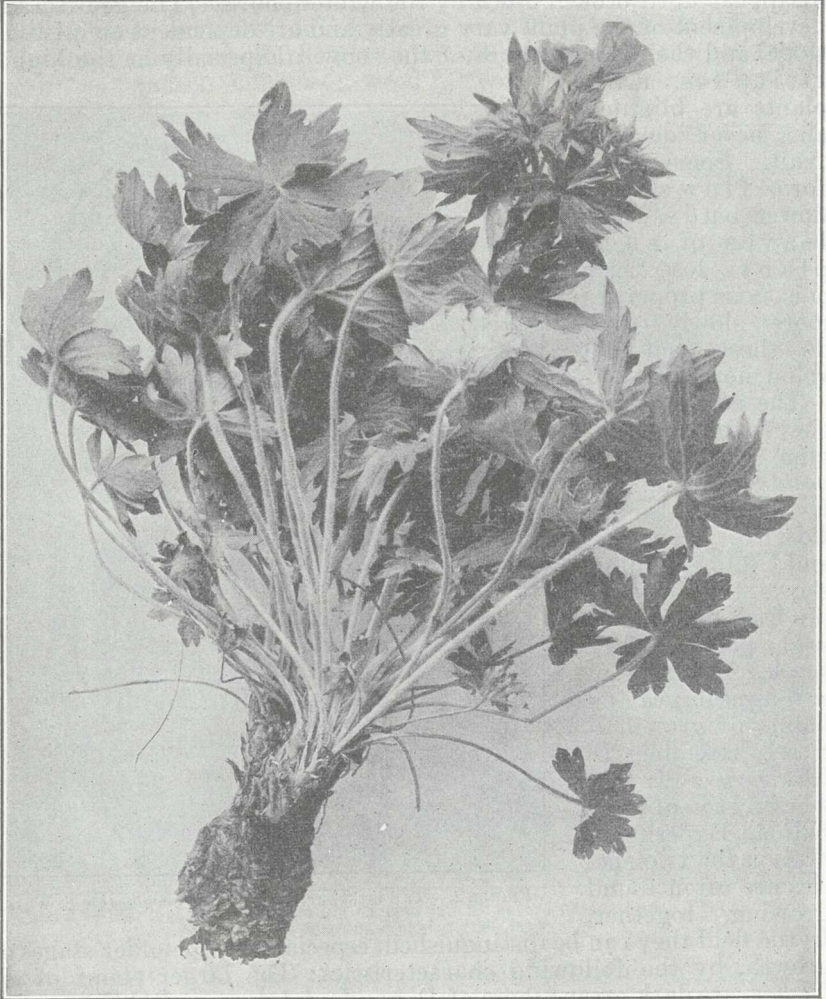


FIGURE 3.—Geranium of mountain regions (*Geranium viscosissimum* F. and N.).

It is not difficult to distinguish the tall larkspur after it blossoms, as no other plant in similar localities has a flower at all resembling it. In the early stages, however, like that represented in figure 1, a person not familiar with the plants may confound it with geranium and aconite (monkshood), both of which frequently grow in abundance in the same places. Figure 3 shows a geranium plant (*Geranium viscosissimum* F. and N.) which may be considered a type of the species of geranium common in the mountain ranges. The

leaves of this geranium resemble those of the tall larkspur. The plant, however, has a very different habit and after blossoming is readily distinguished from the larkspur.

It is more difficult to distinguish the plant of the aconite, an illustration of which is given in figure 4. The plant shown, *Aconitum columbianum* Nutt., may be considered as typical of the aconites found in the mountain regions. It has a flower easily distinguished by its form from that of the larkspur, as will be seen by comparing



FIGURE 4.—Aconite (*Aconitum columbianum* Nutt.).

figures 2, 4, and 5. The color of the aconite flower is commonly deep blue, but it varies through shades of violet, blue, and purple, and in some varieties is greenish white. The leaves resemble those of the larkspur, although they are more closely attached to the stem. The stem of the tall larkspur is hollow, while that of the aconite is pithy. The root of the aconite is short and bulblike instead of long and woody, as in the tall larkspur. Aconite frequently grows in considerable abundance in the midst of clumps of the tall larkspur.

LOW LARKSPUR

Delphinium menziesii D.C. (fig. 5) may be taken as a type of the low larkspurs. This species grows in considerable abundance in Wyoming, Colorado, New Mexico, and Utah; and this or a closely allied species is found also in California and Oregon. It is found at

altitudes of from 4,000 to 10,000 feet on open hillsides and in parks, sometimes covering large areas. The root is short and tuberous and the plant does not usually exceed a foot in height. The blossoms, which are violet blue, appear in May and June, and seeds are formed in the latter part of June or the early part of July, after which the plant dies and disappears. The species illustrated is rarely found in quantity after the middle of July.

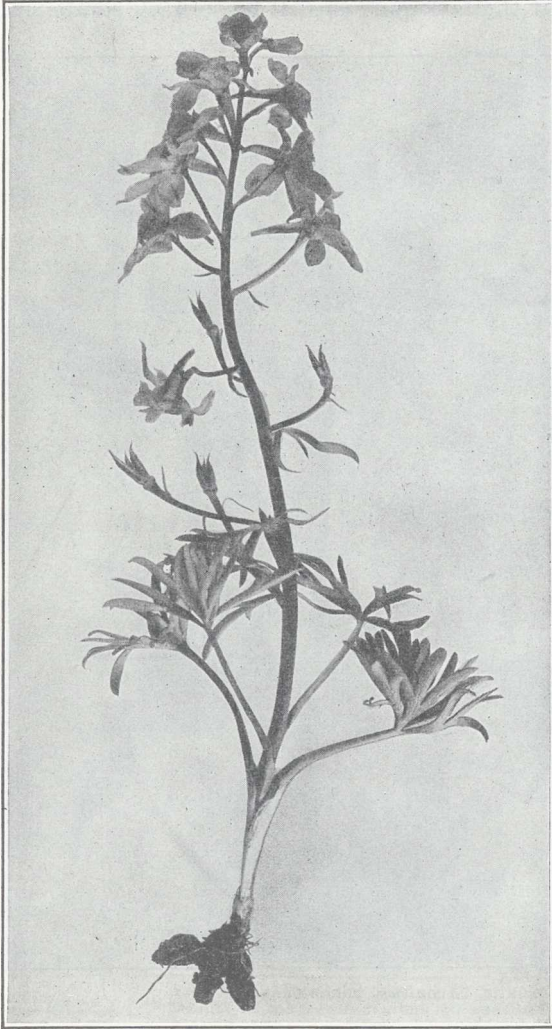


FIGURE 5.—Low larkspur (*Delphinium menziesii* D.C.).

In the States north of Colorado is found a similar larkspur, known as *D. bicolor* Nutt., which resembles *D. menziesii* and has the same general habit of life. The root, however, is long and fibrous, and the blossoms are somewhat larger. It is the most beautiful of the American larkspurs.

In the plains east of the Rocky Mountains is found a white-flowered larkspur, *D. virescens* Nutt., shown in figure 6. It does not ordinarily grow in great abundance, but in some years the plant occurs in sufficient numbers to produce losses, and there are well-authenticated accounts of considerable losses to individual owners. In the Eastern States the species usually reported to cause poisoning of cattle is "dwarf larkspur", *D. tricornis* Michx.;

this plant, commonly called "stagger weed", is from 1 to 3 feet in height and has tuberous roots in clusters. This has caused losses of cattle in the mountains of Virginia and West Virginia, and in neighboring States.



FIGURE 6.—The plains larkspur (*Delphinium virescens* Nutt.).

There is in the Pacific States a red-flowered larkspur, *D. andersoni* Gray, which, like the other species, is poisonous but does not grow in sufficient abundance to cause heavy losses.

In addition, reports from various sources indicate that a number of other species of low larkspur are responsible for the poisoning of livestock at times. Some of these low larkspur, with the general region in which they have been found, are as follows:

D. carolinianum Walt. grows in Virginia, North Carolina, Georgia, Arkansas, and Missouri to Minnesota; *D. decorum* F. and M. is found in California; *D. penardi* Huth occurs in Texas, Oklahoma, New Mexico, Arizona, and Colorado; and *D. scaposum* Greene is found in Utah, New Mexico, and Arizona.

LARKSPUR POISONING

Most of the experimental work has been done with *D. barbeyi* Huth of the tall, and *D. menziesii* D.C., of the low larkspurs, and the conclusions are based largely on what is known of these plants. While it has been generally thought that all species are very similar in their poisonous qualities, it is possible, if not probable, that there are marked differences. Until more is known about them, it is safest to consider them all dangerous.

SYMPTOMS

The first symptom of larkspur poisoning, as noticed on the range, is ordinarily the falling of the animal. When cattle have been feeding upon a larkspur range and are started up suddenly, or are driven, it happens sometimes that one or more of them fall and commence to kick convulsively. While the motions of the animal when down may be described as convulsive, it can hardly be said that the poison produces convulsions. The kicking seems to be due largely to attempts to rise rather than to involuntary contractions of the muscles of the legs. In the experimental poisoning it was found that this falling was usually preceded by constipation, a lack of appetite, general uneasiness, and a stiff and staggering gait. When the animal falls it ordinarily goes down very suddenly, the legs appearing to fail. In the lighter cases of poisoning the animal holds its head erect and after a longer or shorter time gets upon its feet, only to fall again shortly. In more acute cases the animal lies upon its side with the feet extended more or less rigidly. In such cases the animal is unable to get upon its feet immediately. Occasionally it falls once, remains upon the ground a short time, and then walks off as if nothing were the matter. More frequently the fall is repeated several times. If the animal is hurried after being upon its feet the symptoms of poisoning are more severe.

Recovered animals are almost always constipated and usually recover if that condition is relieved. In all severe cases the animals are nauseated, and death frequently results because the contents of the first stomach get into the windpipe. Bloating occurs in some cases but not in all. When the poisoning is sufficiently severe to produce fatal results, death ordinarily comes in a very short time. The symptoms of poisoning by the tall and low larkspurs are the same, and, except for certain details, all the larkspurs of the West apparently produce similar effects.

EFFECTS UPON THE ORGANS OF THE BODY

Cattle fatally poisoned with larkspur bloat almost immediately after death. The autopsies show more or less inflammation of the

stomach, of the small intestine, and of the lining of the windpipe. In most animals that have died from larkspur poisoning more or less of the contents of the first stomach is found in the windpipe and in the bronchial tubes. The blood vessels of the surface of the body are often congested, and ordinarily the kidneys show extreme congestion. Death results from paralysis of the respiratory organs, the heart continuing to beat for an appreciable time after breathing has ceased.

PERIOD DURING WHICH POISONING OCCURS

The low larkspur, as has been stated, is poisonous during its whole life, but the plant disappears the last of June or in July, depending on the altitude and local conditions. Poisoning from eating it very largely occurs, therefore, in May and June. The tall larkspurs are present on the range through the entire season. The leaves, which are more poisonous than the stems, are the most dangerous when the plants are very young. They gradually grow less toxic as the plant approaches maturity. As previously stated, however, many plants blight and never form fruit. The leaves of such plants lose their poisonous properties more slowly than do those that mature normally. These may be responsible for some losses late in the summer. The seeds are much more poisonous than the older leaves and occasionally cause death to cattle late in the season. The loss from eating seeds, however, is very small.

Inasmuch as the leaves of the tall larkspur plants are particularly poisonous before the blossoms are formed, it follows that the most dangerous period of the tall larkspur corresponds very closely to that of the low larkspur, the larger number of cases of poisoning occurring in May and June and the early part of July. In the vicinity of Mount Carbon, Colo., after the middle or last of August cattle eat the leaves of the tall larkspur with considerable eagerness and with no harm whatever.

In some localities like the Sierras, where the snow remains until late in the summer, the growth of the larkspur is delayed and the plants may not reach maturity until fall. Under such circumstances larkspur poisoning may occur very late in the season. Near the Salina Experiment Station in Utah such cases are reported to have rarely occurred on the higher ranges.

Most of the reported losses by the dwarf larkspur of the East have occurred in the spring months—March, April, and May.

During the season when poisoning occurs apparently all parts of the plants above the ground are poisonous. While the roots of *D. barbeyi* are poisonous, they are not eaten, as the cattle are unable to get at them. Contrary to the common belief of cattlemen, very few of the roots of the low larkspur are ever eaten by cattle, and the danger is not from the roots but from the parts of the plant above ground.

QUANTITY OF LARKSPUR NECESSARY TO POISON

While it was formerly thought that cattle must eat the equivalent of at least 3 percent of their own weight of the green plant before being affected, recent work has shown that under certain conditions much smaller quantities may cause poisoning. If the leaves of the very young plants are consumed somewhat rapidly, as little as 0.5

percent of the animal's weight of green material may poison, and 0.7 percent may kill. The stems are somewhat less poisonous than the leaves. As the plant grows older, increasingly large quantities must be eaten to cause poisoning. The leaves of plants in bud are about one half as poisonous as they were before the flower buds began to form, and when the fruits are mature the leaves are only approximately one sixteenth as toxic. Data so far obtained strongly indicate that as compared with the plants at their most poisonous stage, those that blighted before flower buds were formed are, in the late summer, only about one third as poisonous. Similarly, plants that blighted while in bud are about one fifth and those that blighted while in flower approximately one eleventh as toxic.

HORSES NOT AFFECTED ON THE OPEN RANGE

Experimental work showed that horses are poisoned by larkspur if they eat a considerable quantity. On the open range, however, it appears that horses never eat enough of the plant to produce any ill effect, so that they can be grazed without danger upon ranges which would be fatal to cattle.

SHEEP ONLY SLIGHTLY SUSCEPTIBLE

In the early experimental work, it was found that sheep could consume large quantities of the larkspurs, not only without being poisoned, but with apparent benefit. More recently sheep have been poisoned with the *D. barbeyi*. To obtain results, however, it has been necessary for them to consume very large quantities within a comparatively short time. The smallest quantity with which a sheep has been affected has been 3 percent of the animal's weight of the green leaves taken at their most poisonous stage. Others have been fed as much as 4 percent without becoming dangerously ill. For sheep, then, the dosage is approximately six times that for cattle.

While the experimental work and field observations indicate that sheep may sometimes be poisoned, such cases are very rare and probably occur only under abnormal conditions.

PREVENTION

It is, of course, best, if possible, to avoid larkspur poisoning by handling stock so that they will not get at the plants in any quantity. Before the plants begin to form fruit, it is always dangerous to permit stock to graze freely on a larkspur area. This has been recognized by the stockmen on some of the ranges, who by keeping their cattle from the infested areas until after the first of July, prevent losses from low larkspur and most of the losses from the tall larkspur. This is sometimes done by riders. Where ranges are under the supervision of competent herdsmen much can be accomplished in the way of prevention.

In some cases, when limited areas are particularly infested with the plants, it may be desirable to fence them in and keep the cattle out.

Drift fences to keep the cattle below the high larkspur-infested ranges are used successfully in some localities. It should be remembered that when such fences are used it is safe to admit the cattle

after the larkspurs have matured. No definite date can be given when the plant ceases to be injurious, because its maturity varies with the locality and the season. Careful examination should be made before the cattle are admitted. If the plants generally have passed the flowering period and are in seed, the range may be considered as safe unless many of the plants have blighted. In most localities, under ordinary conditions, larkspurs may be considered harmless after September 1.

TREATMENT OF POISONED ANIMALS

When cattle are grazing freely upon a range containing larkspurs and are not immediately under the supervision of riders, deaths from larkspur poisoning cannot be avoided. If, however, the poisoning occurs, as frequently happens, while animals are being driven from one range to another and are under the control of riders, it is sometimes possible to apply remedies that will aid recovery. Many of the cases in which poisoning is not severe will recover if care is taken to turn the animal, after it falls, so that the head will be higher than the rest of the body, and to see that it is not further disturbed. Any attempt to get the animal upon its feet or drive it rapidly is almost certain to be followed by fatal consequences. If the animal bloats badly it should be relieved by paunching—that is, by thrusting a trocar into the first stomach in the manner practiced by many stockmen in the West. When a trocar is not available a knife may be used, the cut being held open until the gas has escaped. Knife wounds, however, do not heal so readily as those made by the trocar. There is no experimental evidence that bleeding produces any good effects. The use of drenches of potassium permanganate, which is recommended in many veterinary manuals and other publications, has been found to be of no value.

In the station work it was found, in all cases, that beneficial results were obtained by using a subcutaneous injection of the following formula:

Physostigmin salicylate.....	1 grain.
Pilocarpin hydrochloride.....	2 grains.
Strychnine sulphate.....	½ grain.

This formula applies to an animal weighing 500 to 600 pounds. For a large steer or cow of 1,000 pounds or more the dose should be twice that given in the formula. These materials can be obtained through a dealer in drugs. The quantity given in the formula should be dissolved in an 8-dram bottle two thirds full of water.

It is best to use an all-metal hypodermic syringe, which can be easily cleaned by boiling. The form which has been found most useful for the field is that known as the Quitman syringe. In this the needles are carried in the hollow piston, and a case is therefore unnecessary. The syringe should be of the 10-centimeter size, which holds one third of an 8-dram bottle of water, so that the remedy can be given to yearlings in a single dose, while for mature cattle the syringe must be used twice. The needle is most conveniently inserted into the shoulder.

Stockmen are accustomed to the use of a hypodermic syringe, and if they are willing to try the remedy can without doubt save the lives of most of the animals poisoned during drives or round-ups. This remedy relieves constipation and stimulates respiration.

ERADICATION OF LARKSPUR

The importance of the subject of larkspur poisoning naturally raises the question of the possibility of ridding the range of the plant. The plants grow so widely and abundantly that anything like complete eradication is impossible. Most of the cases of poisoning, however, occur where the plant grows in thick patches. Such patches are frequently found in gulches or box canyons into which cattle are likely to drift and remain until they eat enough of the larkspur to produce illness or death. In such places it is entirely feasible and economically possible to dig out the plants. Although it is desirable to destroy all the plants in such an area, even an incomplete piece of work may be effective. Inasmuch as many of the shoots from the old roots are somewhat late in starting, the best time for digging the plant, if it is desired to do a thorough piece of work, is when most of the plants are in blossom. Some of the tall larkspurs have short roots and can be pulled. Most of them, however, have long, fibrous roots; in such cases the roots need not be removed entirely, but should be cut off deep enough to prevent further growth. This has been found, by experiment, to be from 6 to 8 inches below the surface. It is best to cut fully 8 inches below the surface, as this will insure that there will be no further growth. Care should be taken that the plants cut out should not be left where cattle can get them, for not only are the dried plants poisonous, but cattle sometimes greedily eat them in that condition. Either they should be scattered so widely that the animals cannot get any considerable quantity, or better, they should be piled and burned.

HORSES AND SHEEP ON LARKSPUR RANGES

From what has been said it is evident that ranges which are particularly harmful to cattle, in most instances, may be used with safety for the pasturage of horses or sheep. Certain ranges where the losses of cattle have been extremely heavy have been used profitably as sheep ranges.

On some ranges, especially those infested with low larkspur, it is possible, by grazing sheep before the cattle are turned in, to destroy enough of the larkspur to make the range safe. This does not succeed so well with the tall larkspur. The sheep, if closely herded, may trample down many of the plants. They much prefer to graze upon the young grasses and the more palatable weeds, and so as a rule do not clear out the larkspurs in a satisfactory manner.



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