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Chemical control of leafy spurge: Summary

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When considering chemical control of leafy spurge (*Euphorbia esula* L.) the nature of its infestation is of paramount importance. Leafy spurge is a very competitive and aggressive perennial plant. It has spread and increased in acreage infested indecent years from isolated areas of Wyoming to where it is reported in most every county of the state. It can be-found on the best agriculture land to the rocky slopes and hilltops of low productive rangeland sites.

Infestations range from solid stands where all other vegetation is virtually eliminated to isolated infestations which serve as a source of seed for its' spread and subsequent usefulness of additional acreages.

Even though leafy spurge infestations on grassland and rangeland sites may not be an indication of misuse, its' presence is undesirable from the standpoint of high productivity of palatable forage. To obtain the maximum sustained productivity of any pasture or rangeland site certain established practices are paramount, one of which is the control or eradication of the least productive and unpalatable species.

Since cultural practices are very expensive and in most cases not practical or adaptable to non-cultivated areas, other methods of control must be made available and utilized. Since other methods of control such as biological methods have not been satisfactory the use of selective chemicals as a means of removing the undesirable herbaceous weed has received considerable attention.

The importance and significance of the leafy spurge infestation in Wyoming can be borne out in the adoption of the "Leafy Spurge Control Act of 1978." The forty-fourth Wyoming Legislature appropriated \$1.4 million for the treatment of this weed. Although \$1.4 million appears to be a very large sum and the program over ambitious and doomed for failure by some, it is a shame this same foresight was not prevalent some 20 years ago, whereby the infestations could have been isolated, controlled or even eradicated then the acreage infested was only a fraction of what it now is.

The chemical control of leafy spurge can be traced from the early research reports of 1937 when sodium chlorate, creosote-kerosene, sulphuric acid, ammonium thiocyanate,

potassium chlorate, kainite and barnyard manure was researched and progressing from the late forties with the introduction of the phenoxy herbicides to what compounds we possess at the present time.

It is very doubtful that new herbicides are going to be available in the near future. The proper selection, use, and understanding of what is now available, future emphasis must be directed toward increasing the effectiveness of the herbicides now available.

Phenoxy compounds

Although there are differences of opinion between researchers and control obtained with 2,4-D, formulations varying between states and even areas within states, the results obtained in Wyoming and rates of use suggested are as follows: The application of light rates of 2,4-D at 2.0 to 6.0 lb ai/A can be used with moderate success. The 2.0-lb/A rate applied at early bud stage will kill the top growth, young seedlings, and prevent seed production for that season. Rates of 4, 6 and 8 lb ai/A has been more effective than lower concentrations. However, with good growing conditions at the time of treatment, the 8 lb rate has not been significantly better than the 4 lb treatment. Where dry conditions prevail, the 8 lb rate of either the ester or amine has produced better control than lesser amounts. Repeated applications of 2 lb of 2,4-D of the ester or amine over a 4-year period has resulted in a control of 25 to 45 percent of the original stand. Two applications per year (both spring and fall) will enhance the percentage control obtained with several years repeated applications necessary to substantially reduce the stand and possibly eradicate the plant.

Heavy rates of 2,4-D amine, 20 to 40 lb ai/A, has consistently given near 80 percent control of the original stand one year following treatment, however, reinfestation occurs by the second year. Fall treatments are suggested over earlier dates of application.

Banvel (dicamba)

Low rates of dicamba are comparable in effectiveness to light rates of 2,4-D. An application rate of 6.0 to 8.0 lb ai/A are required for an average of 80 percent or greater stand reduction. Even at the higher rate of application recovery and reinfestation is almost complete within two years following application. Fall applications appear to be as effective, and in some cases, more effective than earlier treatments. Granular formulations have not appeared to be any more effective than liquid formulations and are more damaging to the associated grass species.

Tordon (picloram)

Picloram is the most consistent and effective herbicide available for control and eradication of leafy spurge. For consistent and longevity of control the 2.0 lb/A is needed. Lower rates are not as effective and reinfestation occurs in a shorter period of time and

subsequent annual applications would generally be required. Fall applications of picloram are usually more consistent than spring applications. Where there have been dense stands of old foliage the granular formulation is more effective than the liquid formulation probably because of tie up of the liquid in the old vegetation reducing the amount of picloram reaching the soil. Granular formulations are more damaging to the associated grass species. Retreatment of leafy spurge seedlings with 2,4-D or light rates of dicamba or combinations of the two should be considered in an eradication program.

Roundup (glyphosate)

Glyphosate at 2.0 to 3.0 lb ai/A will effectively kill 80 to 90 percent of the leafy spurge if applied from the full bloom stage to later in the growing season. Reports of applications as late as September has been effective. Early treatments have not been as effective. Since there is no soil activity from Roundup, follow-up treatments with 2,4-D or light rates of dicamba is necessary. The use of Roundup on infested range sites is not practical because of its activity on grass, bare areas result.

New compounds

Triclopyr or Dowco 290 alone or in combination with 2,4-D has not been effective on leafy spurge.

Combinations

Combinations of dicamba/2,4-D, dicamba/Roundup, or even picloram/2,4-D are no better than the most effective herbicide at the specific rate applied.

Remarks for Table 2 General summary

Carbon County

Treatments made August 4, 1964, were square rod plots. Treatments on September 9, 1964, were applied with a ground rig and were 2 to 3 acres in size. The later treatments seemed to be more effective at the 1.0 lb/A. There was slight grass damage at 2.0 lb/A Tordon 22K and above, but not as severe to grass as Benzabor at 1 1/2 lb/sq rod.

Johnson County

Damage to the grass species were the most severe evaluated in all plots across the state. The succulence of mainly smooth bromegrass in the irrigated meadows account for the severe damage by Tordon applications.

Platte County

Readings are an average of three replications. Several chemicals and combinations resulted in outstanding control one year following treatment.

Sheridan County

Three pounds per acre of Tordon 22K was required for 100 percent control. All other locations 2 lb/A was sufficient.

General summary

Limited data indicates that fall treatments may be more effective than spring treatments.

Tordon 101 (Tordon + 2,4-D) was very effective; however, showed considerable damage to associated grass species at lower rates of picolinic acid per acre than was applied by Tordon 22K.

Tordon Granules (2% picolinic acid) was comparable to equivalent rates of Tordon 22K (acid) but seemed to be more toxic to grasses than the liquid formulations.

Remarks for Table 3

General summary

Carbon County

Leafy spurge treated at the full bloom stage of growth resulted in only fair control. The residual of all chemicals except Tritac D and 2,4-D was prevalent and increased control may be evident by next year.

Laramie County

All treatments included in the demonstration resulted in outstanding control. Leafy spurge seedlings were common in the Banvel treated plots indicating short soil residual.

Johnson County

Plots established in 1964 and evaluated two years following application showed outstanding control. Grass plants in the Tordon 22K treated areas had recovered from the chemical damage recorded in 1965.

Platte County

Considerable variation in leafy spurge control was evident between replications. Approximately one-half of the plots were on native grassland and half on railroad-rights-of-way.

Sheridan County

Benzabor at 1.5 lb/sq rod, Tordon beads at 0.75 and 1.25 lb/sq rod, and Tordon 22K at 1.0 and 3.0 lb/A gave 92 to 100 percent control. All rates of Tordon 22K damaged the native grass species.

| | Plots Established June 2, 1959 | | | | |
|------------------|--------------------------------|-----|-------------------------------------|--|--|
| Treatment | Rate | | Control & Remarks 1960 ² | | |
| Chlorea Gran. 3 | 4 lb/sq. rd. | 80 | Bare spots | | |
| Chlorea Gran. 3 | 6 lb/sq. rd. | 90 | Few plants left | | |
| Chlorea + 2,4-D | 5 lb/sq. rd. | 99 | Few plants left | | |
| Chlorea + 2,4-D | 10 lb/sq. rd. | 99 | Few plants left | | |
| Atlacide + 2,4-D | 5 lb/sq. rd. | 95 | Few plants left | | |
| Atlacide + 2,4-D | 10 lb/sq. rd. | 98 | Few plants left | | |
| Monuron | 1/4 lb/sq. rd. | 75 | Plants yellow & damaged | | |
| Monuron | 1/2 lb/sq. rd. | 75 | Plants yellow & damaged | | |
| Diuron | 1/4 lb/sq. rd. | 50 | Not effective | | |
| Diuron | 1/2 lb/sq. rd. | 50 | Not effective | | |
| Fenuron | 1 lb/sq. rd. | 50 | Not effective, yellow plants | | |
| Fenuron | 2 lb/sq. rd. | 88 | Yellow regrowth | | |
| Simazine | 1/8 lb/sq. rd. | 30 | Not effective | | |
| Simazine | 1/4 lb/sq. rd. | 50 | Not effective | | |
| Atrazine | 1/8 lb/sq. rd. | 99 | Few plants remaining | | |
| Atrazine | 1/4 lb/sq. rd. | 99 | Few plants remaining | | |
| Ureabor | 2 lb/sq. rd. | 97 | Few plants remaining | | |
| Ureabor | 4 lb/sq. rd. | 98 | Few plants remaining | | |
| Ureabor | 6 lb/sq. rd. | 99 | Few plants remaining | | |
| Benzabor | 2 lb/sq. rd. | 93 | Some regrowth | | |
| Benzabor | 4 lb/sq. rd. | 95 | Some regrowth | | |
| D. B. Granules | 3.3 lb/sq. rd. | 99 | | | |
| D. B. Granules | 6.6 lb/sq. rd. | 100 | | | |
| 2,4-D amine | 40 lb/sq. rd. | 97 | Plants remaining are healthy | | |
| 2,4-D amine | 80 lb/sq. rd. | 97 | Plants remaining are healthy | | |
| ATA | 8 lb/sq. rd. | 0 | Not effective | | |
| ATA | 12 lb/sq. rd. | 0 | Not effective | | |
| Amitrol-T | 8 lb/sq. rd. | 0 | Not effective | | |
| Amitrol-T | 12 lb/sq. rd. | 0 | Not effective | | |
| Fenac Liquid | 8 lb/sq. rd. | 90 | Leaves malformed | | |
| Fenac Liquid | 16 lb/sq. rd. | 90 | Leaves malformed, good grass | | |
| TBA | 20 lb/sq. rd. | 70 | Vigorous regrowth | | |
| TBA | 40 lb/sq. rd. | 95 | Good grass | | |

Table 1. Chemical control of leafy spurge (1959-60).

| | Plots Established Sept. 10, 1959 | | | | | |
|------------------|----------------------------------|-------------------------------------|--|--|--|--|
| Treatment | Rate ¹ | Control & Remarks 1960 ² | | | | |
| Chlorea Gran. 3 | 4.5 lb/sq. rd. | 100 | | | | |
| Chlorea Gran. 1 | 9 lb/sq. rd. | 98 | | | | |
| Chlorea Gran. 1 | 6 lb/sq. rd. | 95 | | | | |
| Ureabor | 6 lb/sq. rd. | 99 | | | | |
| Ureabor | 4 lb/sq. rd. | 96 | | | | |
| Atlacide + 2,4-D | 10 lb/sq. rd. | 99 Few scattered small plants | | | | |
| Benzabor | 3 lb/sq. rd. | 100 Grass in plot | | | | |
| Benzabor | 1.5 lb/sq. rd. | 98 Few remaining plants | | | | |
| Monuron | 1/2 lb/sq. rd. | 50 Spurge chlorotic | | | | |
| Monuron | 1/4 lb/sq. rd. | 50 Spurge chlorotic | | | | |
| Atrazine | 20 lb/sq. rd. | 50 Spurge chlorotic | | | | |
| Atrazine | 40 lb/sq. rd. | 96 Spurge chlorotic | | | | |
| ATA | 8 lb/sq. rd. | 85 Healthy spurge | | | | |
| ATA | 4 lb/sq. rd. | 40 Healthy spurge | | | | |
| Fenac Powder | 20 lb/sq. rd. | 99 Good grass | | | | |
| Fenac Powder | 10 lb/sq. rd. | 95 Good grass | | | | |
| Fenac Powder | 5 lb/sq. rd. | 60 Good grass | | | | |
| Fenac Gran. | 400 lb/A | 99 Grass chlorotic | | | | |
| Fenac Gran. | 200 lb/A | 70 | | | | |
| Fenac Gran. | 100 lb/A | 50 | | | | |
| Amitrol-T | 8 lb/sq. rd. | 22 Some chlorosis | | | | |
| Amitrol-T | 4 lb/sq. rd. | 25 Some chlorosis | | | | |
| Fenac Liquid | 20 lb/sq. rd. | 99 | | | | |
| Fenac Liquid | 10 lb/sq. rd. | 95 | | | | |
| Fenac Liquid | 5 lb/Sq. rd. | 80 | | | | |
| 2,4-D amine | 80 lb/sq. rd. | 99 Good grass | | | | |
| 2,4-D amine | 40 lb/sq. rd. | 99 Good grass | | | | |
| TBA | 20 lb/sq. rd. | 90 Residual activity | | | | |
| TBA | 10 lb/sq. rd. | 85 Residual activity | | | | |

Table 1. Continued

¹Rate per acre expressed in pounds active ingredient per acre unless otherwise indicated. ²All plots torn up by new ranch owner in 1961.

| | | | Location | of Plots - Co | ounty Perce | ent Control | Percent |
|---------------------|-------------|-----------|---------------------|---------------|-------------|-------------|-----------------|
| Chemical and Rate/A | A or Sq. Ro | d^1 | Carbon ² | Johnson | Platte | Sheridan | average control |
| Fordon 22K | 1.0 | | 99 | 94 | 96 | 90 | 94 |
| Tordon 22K | 2.0 | | 100 | 100 | 100 | 98 | 99 |
| Tordon 22K | 3.0 | | 100 | 100 | 100 | 100 | 100 |
| Tordon 22K | 4.0 | | 100 | 100 | 100 | 100 | 100 |
| Tordon Granules | 0.3125 | lb/sq rod | | | 97 | | 97 |
| Tordon Granules | 0.6125 | lb/sq rod | | | 100 | | 100 |
| Tordon Granules | 0.75 | lb/sq rod | 100 | | | | 100 |
| Tordon Granules | 0.9375 | lb/sq rod | | | 100 | | 100 |
| Tordon Granules | 1.25 | - | | | 100 | | 100 |
| Tordon Granules | 1.5 | | 100 | | | | 100 |
| Tordon 101 | 1.3 | gal | | | 99 | | 99 |
| Tordon 101 | 2.6 | gal | | | 100 | | 100 |
| Tordon 101 | 3.9 | gal | | | 100 | | 100 |
| Tordon 101 | 5.2 | gal | | | 100 | | 100 |
| Benzabor | 0.75 | lb/sq rod | | | 100 | | 100 |
| Benzabor | 1.5 | lb/sq rod | 98 | 50 | 100 | | 83 |
| Banvel | 5.0 | - | | | 97 | | 97 |
| Banvel | 10.0 | | | | 100 | | 100 |
| Banvel | 15.0 | | | | 100 | | 100 |
| 2,3,6TBA | 10.0 | | | | 100 | | 100 |
| 2,3,6TBA | 20.0 | | | | 100 | | 100 |
| Tritac D | 4.0 | gal | | | 80 | | 80 |
| Tritac D | 5.0 | gal | | 85 | | 85 | 85 |
| Tritac D | 6.0 | gal | | | 100 | | 100 |
| Tritac D | 7.0 | | | | | 90 | 90 |
| Tritac D | 8.0 | | | | 100 | | 100 |
| Fenac Liquid | 5.0 | | | | 75 | | 75 |
| Fenac, Liquid | 10.0 | | | | 99 | | 99 |
| Fenac Liquid | 15.0 | | | | 100 | | 100 |
| Fenac Granules | 0.5 | lb/sq rod | | | 99 | | 99 |
| Fenac Granules | 1.0 | lb/sq rod | | | 100 | | 100 |
| Fenac Granules | 1.5 | lb/sq rod | | | 100 | | 100 |
| 2,4-D amine | 6.0 | | | | 75 | | 75 |
| 2,4-D amine | 20.0 | | | | 85 | | 85 |
| 2,4-D amine | 40.0 | | | | 90 | | 90 |
| 2,4-D LVE | 2.0 | | | | 20 | | 20 |
| 2,4-D LVE | 4.0 | | | | 20 | | 20 |
| 2,4-D LVE | 6.0 | | | | 60 | | 60 |
| 2,4-D LVE + X-77 | 2.0 | | | | 30 | | 30 |
| 2,4-D LVE + X-77 | 4.0 | | | | 70 | | 70 |
| 2,4-D LVE + X-77 | 6.0 | | | | 80 | | 80 |
| Dacamine | 6.0 | | | | 65 | | 65 |

Table 2. Leafy spurge summary - 1965 evaluations

¹Plots established in spring or fall of 1964. Evaluated 1965. Rate/A in pounds active per acre unless otherwise stated. ²Both spring and fall treatments included in evaluation.

| | | | Location | of Plots-Cour | ty Percent C | ontrol | | Range of |
|-----------------|-----------|----------------------|----------|---------------|--------------|----------|-----------|----------|
| Chemical and Ra | te/A or S | Sq. Rod ¹ | Carbon* | Johnson** | Laramie* | Platte** | Sheridan* | control |
| Tordon 22K | 1.0 | | 85 | 97 | 100 | 82 | 96 | 82-96 |
| Tordon 22K | 2.0 | | 95 | 99 | 100 | 99 | 100 | 95-100 |
| Tordon 22K | 3.0 | | | 100 | | 100 | | 100 |
| Tordon 22K | 4.0 | | | | | 100 | | 100 |
| Tordon Granules | 0.3125 | | | | | 99 | | 99-100 |
| Tordon Granules | 0.5 | lb/sq rd | | | 100 | | | 100 |
| Tordon Granules | 0.6125 | lb/sq rd | | | | 100 | | 100 |
| Tordon Granules | 0.75 | lb/sq rd | 75 | 96 | 100 | | 99 | 75-100 |
| Tordon Granules | 0.9375 | lb/sq rd | | | | 100 | | 100 |
| Tordon Granules | 1.25 | lb/sq rd | 80 | 100 | 100 | 100 | 100 | 80-100 |
| Tordon 101 | 1.0 | gal | | | 99 | | | 99 |
| Tordon 101 | 1.3 | gal | | | | 90 | | 85-95 |
| Tordon 101 | 2 | gal | | | 100 | | | 100 |
| Tordon 101 | 2.6 | gal | | | | 96 | | 95-98 |
| Tordon 101 | 3.9 | gal | | | | 99 | | 98-100 |
| Tordon 101 | 5.2 | gal | | | | 100 | | 100 |
| Benzabor | 0.75 | lb/sq rd | | | | 90 | | 80-100 |
| Benzabor | 1.5 | lb/sq rd | 30 | 93 | | 98 | 92 | 97-100 |
| Banvel | 5.0 | | | | 90 | 77 | | 70-90 |
| Banvel | 10.0 | | | | 97 | 90 | | 90-97 |
| Banvel | 15.0 | | | | | 96 | | 95-100 |
| 2,3,6TBA | 10.0 | | | | | 96 | | 95-98 |
| 2,3,6TBA | 15.0 | | | | | 98 | | 98 |
| 2,3,6TBA | 20.0 | | | | | 100 | | 100 |
| Tritac D | 5.0 | | | 85 | | | | 85 |
| Tritac D | 6.0 | | 40 | | 99 | | | 40-99 |
| Tritac D | 8.0 | | | | 100 | 50 | | 20-100 |
| Tritac D | 12.0 | | | | | 94 | | 90-98 |
| Tritac D | 16.0 | | | | 98 | | | 98 |

 Table 3. Leafy spurge summary - 1966 evaluation.

| | | L | ocation of Plo | ots-County P | Percent Con | itrol | Range of |
|--------------------|---------------------------|---------|----------------|--------------|-------------|-----------|----------|
| Chemical and Rate/ | A or Sq. Rod ¹ | Carbon* | Johnson** | Laramie* | Platte** | Sheridan* | control |
| Fenac Liquid | 5.0 | | | | 50 | | 10-90 |
| Fenac Liquid | 10.0 | | | | 90 | | 85-95 |
| Fenac Liquid | 15.0 | | | | 99 | | 99-100 |
| Fenac Granules | 0.5 lb/sq rd | | | | 97 | | 95-100 |
| Fenac Granules | 1.0 lb/sq rd | | | 100 | 100 | 85 | 85-100 |
| Fenac Granules | 1.5 lb/sq rd | | | | 100 | | 100 |
| 2,4-D amine | 6.0 | | | | 20 | | 10-30 |
| 2,4-D amine | 20.0 | | | | 30 | | 10-50 |
| 2,4-D amine | 40.0 | | | | 79 | | 60-98 |
| 2,4-D LVE | 2.0 | | | | 57 | | 15-99 |
| 2,4-D LVE | 4.0 | | | | 47 | | 0-95 |
| 2,4-D LVE | 6.0 | 70 | | | 25 | | 10-70 |
| 2,4-D LVE + X-77 | 2.0 | | | | 5 | | 0-10 |
| 2,4-D LVE + X-77 | 4.0 | | | | 17 | | 10-25 |
| 2,4-D LVE + X-77 | 6.0 | | | | 20 | | 0-40 |
| Dacamine | 6.0 | | | | 15 | | 0-30 |

Table 3. Continued.

*Readings one year following treatment. **Readings two years following treatment. ¹Rate per acre expressed in pounds active ingredient unless otherwise states.

| | | | % Control | | |
|-----------------------|---------------------|----------|-----------|---------|-----------------------|
| Chemical ¹ | Rate/A ² | 67/11/65 | 5/23/66 | 8/16/67 | Remarks |
| Banvel | 5.0 | 97 | 77 | 20 | |
| Banvel | 10.0 | 100 | 90 | 20 | |
| Banvel | 15.0 | 100 | 96 | 50 | Moderate grass damage |
| 2,3,6TBA | 10.0 | 100 | 96 | 70 | |
| 2,3,6TBA | 15.0 | 100 | 98 | 98 | Grass thinned |
| 2,3,6TBA | 20.0 | 99 | 100 | 90 | Grass thinned |
| Fenac Liquid | 5.0 | 75 | 50 | 0 | |
| Fenac Liquid | 10.0 | 98 | 90 | 60 | |
| Fenac Liquid | 15.0 | 100 | 99 | 98 | Some grass damage |
| Fenac Granules | 0.5 lb/sq rod | 98 | 97 | 95 | |
| Fenac Granules | 1.0 lb/sq rod | 100 | 100 | 95 | Grass damage |
| Fenac Granules | 1.5 lb/sq rod | 100 | 100 | 100 | Grass damage |
| Tritac D | 8.0 | 78 | 50 | 70 | |
| Tritac D | 12.0 | 99 | 94 | 65 | |
| Tritac D | 16.0 | 99 | 98 | 90 | |
| Benzabor | 0.75 lb/sq rod | 100 | 90 | 90 | |
| Benzabor | 1.5 lb/sq rod | 100 | 98 | 100 | |
| Tordon 22K | 1.0 | 96 | 83 | 55 | |
| Tordon 22K | 2.0 | 100 | 99 | 98 | |
| Tordon 22K | 3.0 | 100 | 100 | 100 | |
| Tordon 22K | 4.0 | 100 | 100 | 100 | |
| Tordon 101 | 1.3 gal/A | 99 | 90 | 100 | |
| Tordon 101 | 2.6 gal/A | 99 | 96 | 100 | |
| Tordon 101 | 3.9 gal/A | 100 | 99 | 100 | Grass damage |
| Tordon 101 | 5.2 gal/A | 100 | 100 | 100 | Grass damage |
| Tordon Granules | 0.3125 lb/sq rod | 97 | 99 | 100 | |
| Tordon Granules | 0.625 lb/sq rod | 100 | 100 | 95 | |
| Tordon Granules | 0.9375 lb/sq rod | 100 | 100 | 100 | |
| Tordon Granules | 1.25 lb/sq rod | 100 | 100 | 100 | |
| Dacamine | 6.0 | 65 | 15 | 0 | |
| Amitrol T | 8.0 | 50 | 15 | 25 | Grass damage |

Table 4. Leafy spurge control three years following treatment. Platte County.

¹Plots established May 15, 1964. Carrier 40 gpa water. ²Rate/A in pounds per acre active ingredient unless otherwise stated.

| | | % Contro | 1 | |
|----------------------|--------------|----------|---------|----------------------------|
| Treatment | Rate lb ai/A | 6/15/76 | 6/17/77 | Remarks (1976) |
| Triclopyr | 1.5 | 0 | 0 | No stand reduction |
| Triclopyr | 3.0 | 0 | 0 | Knockdown only |
| Triclopyr + 2,4-D A | 1.5 + 1.0 | 0 | 0 | Knockdown only |
| Triclopyr + 2,4-D A | 3.0 + 1.0 | 0 | 0 | Knockdown only |
| Dowco 290 | 1.0 | 0 | 0 | Poor activity |
| Dowco 290 | 2.0 | 0 | 0 | Poor activity |
| Dowco 290 + 2,4-D A | 1.0 + 1.0 | 0 | 0 | Poor activity |
| Dowco 290 + 2,4-D A | 2.0 + 2.0 | 0 | 0 | Poor activity |
| Picloram | 1.0 | 98 | 80 | Few small spurge |
| Picloram | 2.0 | 98 | 90 | Smooth brome prostrate |
| Picloram + 2,4-D | 1.0 + 2.0 | 96 | 80 | Few small spurge |
| Picloram + 2,4-D | 2.0 + 4.0 | 98 | 90 | Smooth brome prostrate |
| Picloram + Dicamba | 0.25 + 2.0 | 80 | 0 | Healthy spurge |
| Picloram + Dicamba | 0.5 + 2.0 | 88 | 0 | New regrowth |
| Dicamba | 2.0 | 20 | 0 | |
| Dicamba | 4.0 | 50 | 0 | No grass damage |
| Dicamba | 8.0 | 80 | 0 | No damage to grass |
| Vel-5027 | 4.0 | 50 | 0 | Knockdown early |
| Vel-5027 | 8.0 | 60 | 0 | Knockdown early |
| Dicamba + 2,4-D | 1.0 + 3.0 | 70 | 0 | Recovery later |
| 2,4-D A | 6.0 | 40 | 0 | Spurge healthy |
| 2,4-D A | 20.0 | 80 | 0 | Spurge healthy |
| Glyphosate | 2.0 | 80 | 0 | Good early-no residual |
| Glyphosate | 3.0 | 85 | 0 | Good early-no residual |
| Glyphosate + 2,4-D A | 1.0 + 2.0 | 50 | 0 | Good knockdown-no residual |

Table 5. Leafy spurge control. Johnson County. Established June 25, 1975. Full bloom. Soilloam. Carrier-water 40 gpa.

| | | % Co | ontrol | |
|--------------|-----------------------|---------|---------|------------------------|
| Chemical | Rate/A ¹ | 5/17/66 | 5/18/67 | Remarks |
| Tordon 22K- | 1.0 | 96 | 98 | Hounds tongue in plots |
| Tordon 22K | 2.0 | 100 | 100 | |
| Tordon 22K | 3.0 | 100 | 100 | |
| Tordon Beads | 0.75 <i>lb/sq</i> rod | 99 | 99 | Bluegrass not damaged |
| Tordon Beads | 1.25 <i>lb/sq</i> rod | 100 | 100 | Bluegrass not damaged |
| Benzabor | 1.5 lb/sq rod | 92 | 98 | |
| 2,4-D LVE | 6.0 | 45 | 40 | |

Table 6. Leafy spurge control- Johnson County-Fred Brug Ranch. Established May 20,1965.

¹Rate per acre expressed as pounds active ingredient unless otherwise stated.

Table 7.

| | | % Control | |
|--------------|---------------------|-----------|-----------------------------|
| Chemical | Rate/A ¹ | 7/10/68 | Remarks |
| Tordon 101 | 1 gal | 50 | Healthy leafy spurge |
| Tordon 101 | 2 gal | 85 | Small leafy spurge plants |
| Tordon 212 | 0.5 gal | 40 | Healthy leafy spurge |
| Tordon 212 | 1.0 gal | 65 | Small leafy spurge plants |
| Tordon Beads | 0.75 lb/sq rod | 100 | Bluegrass browned |
| Tordon Beads | 1.0 lb/sq rod | 100 | Bluegrass browned |
| Tordon 22K | 1.0 | 50 | Healthy leafy spurge plants |
| Tordon 22K | 2.0 | 96 | Small leafy spurge plants |

¹Rate per acre expressed as pounds active ingredient unless otherwise stated.

| Herbicide | Rate lb ai/A | % Control ² | Observations |
|----------------------|--------------|------------------------|--------------------------|
| Picloram | 2.0 | 100 | 30% reduction of grass |
| Picloram | 3.0 | 100 | 50% reduction of grass |
| Picloram | 4.0 | 100 | 70% reduction of grass |
| Picloram + 2,4-D | 2.0 + 4.0 | 100 | 30% reduction of grass |
| Picloram + 2,4-D | 3.0 + 6.0 | 100 | 50% reduction of grass |
| Picloram 2% beads | 2.0 | 100 | 20% reduction of grass |
| Picloram 2% beads | 3.0 | 100 | 50% reduction of grass |
| Picloram 10% pellets | 2.0 | 95 | Bare spots in plots |
| Picloram 10% pellets | 3.0 | 100 | Bare spots in plots |
| Picloram + 2,4,5-T | 2.0 + 4.0 | 98 | Some grass damage |
| Picloram + 2,4,5-T | 3.0 + 6.0 | 100 | Some grass damage |
| Dicamba | 6.0 | 95 | Good grass cover |
| Dicamba | 8.0 | 99 | Good grass cover |
| Dicamba 10% granules | 6.0 | 80 | Bare spots-poor coverage |
| Dicamba 10% granules | 8.0 | 90 | Bare spots-poor coverage |
| Dicamba + 2,4-D | 4.0 + 12.0 | 90 | Good grass cover |
| Dicamba + 2,4-D | 6.0 + 18.0 | 90 | Good grass cover |
| Dowco 290 (M-3972) | 2.0 | 50 | Good grass cover |
| Dowco 290 (M-3972) | 3.0 | 50 | Good grass cover |
| Glyphosate + Dicamba | 1.0 + 2.0 | 50 | Good grass cover |
| Glyphosate + Dicamba | 1.0 + 3.0 | 50 | Good grass cover |
| Glyphosate | 2.0 | 50 | 30% reduction of grass |
| Glyphosate | 3.0 | 80 | 50% reduction of grass |
| DPX-1108 | 4.0 | 0 | |
| DPX-1108 | 6.0 | 40 | |
| R-40244 | 2.0 | 0 | |

 Table 8. Leafy spurge control. Carbon County. Established July 12,28. Raju, M.V.S., R.T.

 Coupland, and T.A. Steeves. 1966. On the occurrence of root buds on the perennial plants in Saskatchewan. Can. J. Bot. 44:33-37.

¹Herbicides applied July 12, 1977 to pasture heavily grazed by sheep. Grass less than 1-in. leaf height. ²Evaluated July 14, 1978.