TechLine

Information for Noxious Weed Control Professionals

January, 1989

"False facts are highly injurious to the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for everyone takes a salutary pleasure in proving their falseness."
... Charles Darwin

Welcome to the first issue of TechLine. As Technical Service and Development (TS&D) representatives for The Dow Chemical Company, we serve a vast geography and enjoy the opportunity of coordinating scores of projects with an expanding number of scientists and researchers.


Dean Gaiser
Spokane, WA


Mary McKone
Billings, MT


Mark Peterson
Brookings, SD

Thus, we begin this newsletter to more efficiently supply information about our common work as well as explore your questions more thoroughly. And TechLine will provide a refreshing forum for your successes specific to you and our region. Our objectives are to concentrate on the following areas:

1. Technical Knowledge:

Many of you have worked with agricultural chemicals for a long time. But, there are always new questions. TechLine is designed to provide you with technical information on all facets of our agricultural products.

2. Product Registration:

We regularly develop new products or obtain new labeling for existing products. TechLine will keep you better informed on these compounds as well as discuss the process behind new product development.

3. Exchange of Ideas:

We see a lot of innovative research studies and weed control projects and we know that pest control is more than just chemicals. Integrated control programs have our full support and we want TechLine to further disseminate timely and sensible reports on current research.

Several of you are already involved with or managing successful weed management programs. The development of an integrated, comprehensive, and carefully planned management program has been a key ingredient in your success. These programs will be featured in TechLine.

4. Input from You:

We want to answer your particular technical questions about our products and other aspects of well-planned weed control programs. Are there certain questions that always come up about our products that we should address?

Also, if you have a research project or successful weed control project you would like to share with our readers — your colleagues — we welcome them.

5. Return Card:

This issue contains a return card. Please pass along the names and addresses of others whom you feel would be interested in receiving TechLine. And use the card to let us know what information should be included in a future issue, or to inform us about your work so we might share it in a future issue.

If you have additional questions for TechLine or questions relating to subjects covered in its contents, please call us at the numbers listed above or call (406) 652-4977. Again, welcome to TechLine. ◆

In This Issue:

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Montana Research

Grass Response Following Spotted Knapweed Control

By Don Bedunah, Ph.D
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During the fall of 1987, seven ranches in western Montana were studied to evaluate the influence of spotted knapweed control and grass production. In general, the ranchers were very pleased with the grass response that followed control of the knapweed. In most cases, the increase in grass production was approximately the same as the decrease in knapweed production by two years following treatment.

Spotted knapweed was generally the only significant forb standing crop. The exceptions were on Nicholson's Ranch where Northwest cinquefoil averaged 317 lb./acre (not a desirable forb) and possibly on the Johnson Ranch where there was an apparent increase in native forbs from spraying knapweed. In most cases, knapweed seedlings on the sprayed sites similar to what has been observed in other test plots.

Table 1 summarizes the findings that are discussed in more detail ranch by ranch.

Ross and Rod McIntyre Ranch: Stevensville, MT

The sample site on the McIntyre Ranch was a crested wheatgrass field with a southwest slope of approximately 5%. The site would probably have been classified as a silty range site in the 10-14 inch precipitation zone (P.Z.) before being plowed. The site had been grazed by livestock which most certainly decreased the standing crop of grasses and knapweed on both sprayed and non-sprayed areas.

The sprayed area had an increase of 1,001 lb./acre of standing grasses compared to the non-sprayed area. Approximately 80% of the standing grass crop was crested wheatgrass. Major native grass species, in order of dominance, were Junegrass, bluebunch wheatgrass, sandberg bluegrass, and Idaho fescue.

Forbs, other than spotted knapweed, were a very minor component (estimated at less than 1% by weight) for the sprayed and non-sprayed sites. Annual mustards were the most frequently encountered forb on the sprayed site. Fringed sage, a half shrub, was common on the sprayed and non-sprayed areas but was not important on a weight basis.

Spotted knapweed averaged 65 lb./acre on the sprayed area compared to 827 lb./acre on the non-sprayed area. Knapweed had flowered and produced seed on the sprayed site but the density of knapweed plants was still very reduced compared to the non-spray site. Nineteen knapweed plants per square meter (/m^2) were measured on the sprayed site compared to 131 knapweed plants/m^2 on the check site.

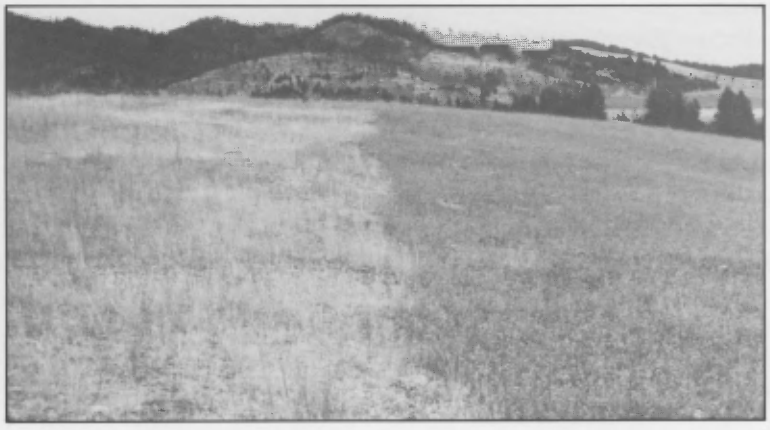
The site was treated with TORDON* 22K herbicide at a rate of 1 pt./acre in the spring of 1985. It is expected that grass production will remain much greater on the sprayed site for approximately two more years. However, knapweed will increase on the sprayed site and the site will not appear very "clean." Since 1987 was such a dry year, the relatively high grass production for this site was a surprise.

Max Johnson Ranch
Ravalli, MT

The site sampled on the Johnson Ranch was a silty cool range site in the 15-19 inch precipitation zone. The site was comprised of a rough fescue habitat type and dominant grasses included western fescue, Kentucky bluegrass, and Idaho fescue. Minor grasses were rough fescue, bluebunch wheatgrass, Junegrass, and sandberg bluegrass. This area is an important wildlife area. Spraying the area (in strips) resulted in an increase in grass standing crop from 30 lb./acre to 984 lb./acre where the knapweed was controlled. Knapweed standing crop was 1,275 lb./acre which is the approximate increase in grasses and forbs.

This site also had an important native forb and shrub component. The dominant forbs for sites sprayed by TORDON 22K herbicide were prairie smoke (80%), northwest cinquefoil (10%) and 10% listed unknowns. For areas not sprayed there was less forb biomass (excluding knapweed) and apparently the knapweed was reducing native forbs. The dominant native forbs for the spray site were prairie smoke (45%), northwest cinquefoil (35%), western yarrow (15%), and anemone (5%) on a weight basis.

The area also had several common shrubs and trees which were not severely affected by the spraying. Only a few tree seedlings received significant leaf scorch as only a couple of dead Douglas-fir seedlings were found.



Contrast between the sprayed (left) and non-sprayed site on the McIntyre ranch, Stevensville, MT.

Shrubs such as serviceberry, rose, and snowberry were abundant on the site and a few were occasionally "burned", but it did not appear that shrubs were affected by the spray treatment. Fringed sage, a half-shrub, was common on the spray areas and was apparently not harmed.

Charles Deschamp Ranch: Missoula, MT

Spraying of spotted knapweed resulted in a very significant response of grasses on a silty range site even in a drought year. Total grass standing crop was 1,620 lb./acre for the sprayed area compared to only 48 lb./acre for the untreated site. The sprayed site was dominated by Kentucky bluegrass (55%), smooth brome (40%), timothy (3%), and bluebunch (2%); whereas the non-sprayed area was dominated by knapweed. Of the grass standing crop on the non-spray site Kentucky bluegrass (50%), wheatgrass species (45%), and smooth brome (5%) were dominants. Native forbs were rare on both the sprayed and non-sprayed site.

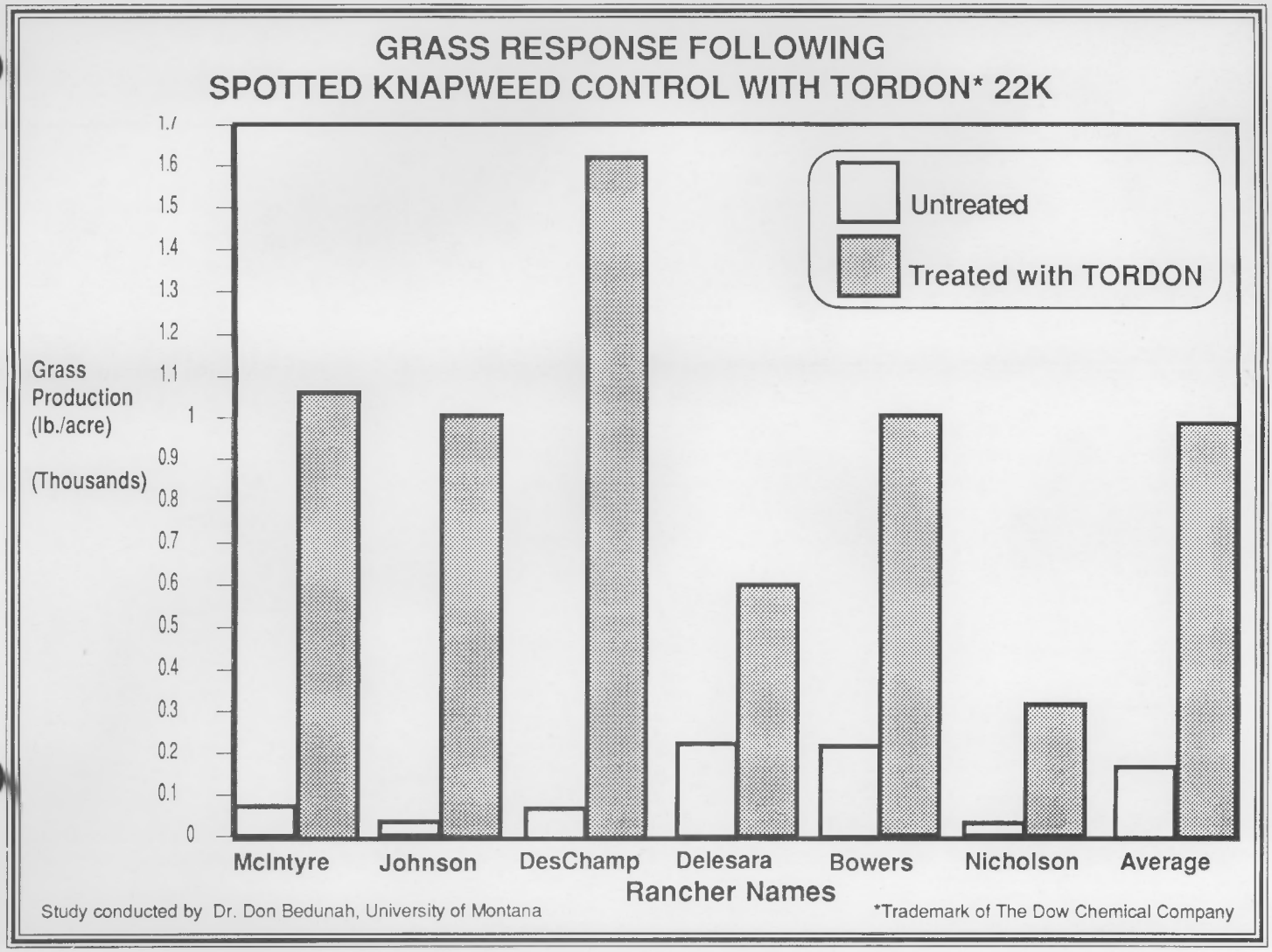
Ed Delesara Ranch: Anaconda, MT

The area sampled was a dry site (thin hilly range site 10-14 inch P.Z.) with a 30% south facing slope. Although the productivity of this site is not high, the site was interesting for several reasons. The site had a significant tree, shrub, and native forb component and was excellent wildlife habitat. Spraying increased grass standing crop and reduced knapweed without having a large noticeable effect on cover of tree or shrubs. There was some leaf burn on limber pine and juniper seedlings. I also found a few dead limber pine seedlings but I did not find dead juniper seedlings. There was some damage (slight to moderate as estimated from leaf burn) to chokecherry, serviceberry, and snowberry but I did not see any dead plants. Rabbitbrush apparently suffered moderate damage.

Grass standing crop was 566 lb./acre on the sprayed site compared to 236 lb./acre for the non-sprayed site. For this site it was difficult to locate the same type of areas to sample because of a difference in grazing history on the outside of the fence. Knapweed standing crop was 545 lb./acre on the non-spray site which probably represents the approximate increase in grass production from spraying.

Stoneseed received significant damage on the sprayed area; although, there were still a lot of live plants remaining. Two forbs, a penstemon and one similar to alpine forget-me-not, were also common on the site and no damage was observed from the spray. Knapweed seedlings were common on the sprayed areas (greater than 1/m^2), but there was no flower production observed. However, it is projected that this area may need retreatment by 1989.

See "Grass" On Page 6.



Soils and Groundwater

George Oliver

By George Oliver

George Oliver is a soil scientist who has done extensive research on the fate of pesticides in soils. During his six years with Dow he has devoted much of his efforts to product stewardship functions designed to ensure that pesticides are used properly and without adverse environmental impact. George has a PhD in soil science, and worked for the Soil Conservation Service (SCS) prior to joining Dow.

There are two types of soil conditions which users of herbicdes should be most concerned with, according to Oliver.

"The first condition is where soils have a very high permeability allowing water to travel quickly down through the entire soil profile and the water table is shallow," he explains. "Generally, these soils will have textures of loamy sand to sand all the way through the profile to the water table.

"The second condition involves soils that have a direct route of movement connecting the surface with an aquifer below," he adds. "This would primarily include sinkholes, which are usually found in areas with shallow limestone bedrock, as well as areas with highly fractured bedrock exposed at or very near the surface."

Sites with these two types of soil conditions are not scattered randomly across the country, but are for the most part concentrated in certain regions. Sandy areas with shallow water tables are most likely to occur in coastal regions or near inland bodies of water, rivers, or streams. Fractured bedrock, however, is generally found in mountainous areas. Sinkholes are most common in areas with limestone caverns, such as those found in some portions of the Appalachian Mountains and in parts of northeast Iowa.

Analyze your program:

If these soil conditions do occur in areas where herbicides are used, the location of the sites should be identified and the vegetation management program for those sites analyzed, Oliver says.

"If either of these soil conditions are present it doesn't necessarily mean you have to rule out herbicides completely, but you do need to carefully evaluate the materials and application methods to ensure an environmentally safe operation," he explains. "For example, if you're in an areas where a broadcast spray treatment with a particular herbicide may have a higher chance of reaching groundwater, several other alternatives may be acceptable. Other choices might include applying lower rates, changing to a different application method such as cut-surface or basal application, or using alternative management techniques.

"There are a lot of variables to consider. Obviously no one type of treatment or any one product is ideally suited to all conditions," he adds. "In most situations herbicides can by used effectively and safely, but in some instances manual or mechanical treatments may be more appropriate. With mechanical treatments, however, adverse environmental impact must also be considered. For example soil erosion caused by heavy equipment can result in more problems than a herbicide treatment."

Consult with specialists:

Herbicide users who have questions about products or soil conditions should check with their industry sales or technical service representative, the local SCS office, or a Cooperative Extension Service agent.

"It's important to talk with specialists who can help analyze a particular situation and help you determine what the best alternatives are," Oliver says. "The SCS or Extension service can help you identify areas with high risk soil conditions, and may even be able to assist with on-site analysis."

Oliver adds that chemical industry representatives should also be consulted on whether a herbicide manufactured or sold by that company is appropriate to use at a specific site.

"If you do have sites where soil conditions are questionable, the potential problems may not be avoided merely by using another herbicide," Oliver adds. "The fact is, any substance, whether it's synthetic or natural, can reach groundwater if certain soil and climatic conditions are present. Ask your industry representative why his/her product is safe to use under conditions that would not be acceptable for another product."

Mobility in soil:

Oliver notes that users of TORDON* 22K herbicide frequently have questions about the mobility of TORDON 22K in the soil.

"These questions frequently concern broadcast applications followed by heavy rains," Oliver says. "People want to know if this kind of situation will cause the herbicide to leach down through the soil and into groundwater, even in areas where the water table is deep. Other similar questions deal with lateral movement of the chemical. Will the herbicide move once it's in the soil and be taken up by plants off the right-of-way or the application site?

"The bottom line is that under the right conditions —or wrong conditions— any substance can move," he

See "Oliver" On Page 6.

Toxicology

By Joanne Betso

Joanne Betso, supervisor of the Dow Chemical Health and Environmental Sciences Information Center, is a chemist and certified toxicologist. She has researched toxicological properties and mammalian health hazards of TORDON 22K herbicide and a wide range of other pesticides and chemicals over the last 14 years.*

Relative health hazards, toxicity, and exposure during application are three key areas of concern to most people, according to Joanne Betso.

"In essence, TORDON 22K is active against vegetation but low in toxicity to mammals," she explains. "This selectivity is due to the fact that the TORDON 22K molecule is active within plant metabolism but does not interact within cells in mammals.

"There is a large safety factor between the amounts required for effective vegetation control and exposures that might be toxic to humans and animals," she adds. "However, when people observe the often impressive results of a herbicide application, they conclude that the material must be similarly powerful against humans."

Hazard versus toxicity:

Betso notes that hazard is a function of both toxicity ad dose (or exposure). Hazard can vary because the dose, or exposure situation, changes. Toxicity, however, remains the same for a given material because it is a property of a chemical.

"Picloram is of low hazard because it is low in toxicity to mammals, and exposures can be easily managed," Betso adds.

With all herbicides, exposure can affect the applicator, or a bystander, which can be an animal or a human who happens to be in the area during application or who walks through an area shortly after application. Exposure for applicators or bystanders can occur via three routes: Orally, through the skin, and by inhalation.

Margin of safety:

"Animal tests as well as controlled human studies show that when exposure occurs, the active ingredient molecule in TORDON 22K is not metabolized in the body but is excreted as the parent acid, that is, unchanged, in the urine," Betso says.

"This excretion occurs rapidly," she adds. "Following a single oral dose, nearly all of it is eliminated in two to three days. In the case of skin contact, human data show that very little of it is actually absorbed through the skin, and uptake through the skin is slow. As far as inhalation, TORDON 22K presents minimal concern due to its physical properties and inherently low systemic toxicity."

Because TORDON 22K is excreted unchanged in the urine of exposed humans, it is possible to estimate the doses absorbed by applicators by measuring urinary excretion of the parent material. Results of such studies on applicators confirm that there is a very high margin of safety —nearly 1,000-fold or greater depending on application method and other factors — between doses of TORDON 22K absorbed by applicators and the no-effect levels established in animal studies.

"These studies have also shown the importance of protective clothing in reducing exposure," Betso says. "Even though dermal absorption is minimal, the primary route of herbicide uptake for applicators is still the skin, particularly in the areas of the hands and thighs."

To summarize, Betso notes that all evidence from toxicological studies over the last 20 years indicates that:

1. TORDON 22K is low in mammalian toxicity.
2. Doses to applicators engaged in normal field application activities are significantly below "allowable daily intakes" including occupational guidelines or allowable daily intakes from crop residues.
3. Exposures to TORDON 22K can be easily managed, and normal uses do not present a health hazard.
4. Protective clothing and good personal hygiene are important for reducing exposures.
5. Since the hazard for applicators is minimal, bystanders, who will receive much lower exposures, are not at risk. ◆

Joanne Betso

"Grass"

Continued from page 3.

Charles Bowers Ranch
Hall, MT

Charlie Bowers is producing grass and almost no knapweed. This ranch had a beautiful stand of native grass and only a very few patches of knapweed. The sites sampled were silty range sites (10-14 inch P.Z.). Grass standing crop was 1,010 lb./acre for sprayed areas compared to only 242 lb./acre on non-sprayed areas. Spotted knapweed was estimated to produce at a rate of approximately 1,400 lb./acre on non-sprayed areas. The dominant grasses were bluebunch wheatgrass(70%), western wheatgrass (10%), Junegrass (10%), bluegrasses (5%), Idaho fescue (2%), and a trace of rough fescue, needle-and-thread, and bluegrama.

The reason for such a low number of forbs may be from past heavy sheep grazing. Forbs that were apparently injured by the spray were fleabane and hairy golden aster. Forbs that did not appear to be injured were scarlet globemallow, commandra (common toadflax), and an annual mustard (pepperseed).

His ranch is an excellent site to show people what type of grass you can produce from controlled knapweed sites.

Del Nicholson Ranch
Arlee, MT

An old field was sampled that was sprayed in June 1987. The site was near an old homestead and has probably received past heavy grazing. Kentucky bluegrass comprised over 95% of the graminoids. Spotted knapweed and a herbaceous cinquefoil (northwest cinquefoil) were 99% of the forb standing crop. Del Nicholson sprayed because of knapweed and the herbaceous cinquefoil.

The site had not had time to fully respond to the spray; although grass standing crop was 309 lb./acre for the sprayed area compared to only 15 lb./acre for the non-sprayed site (sampled non-sprayed areas were in spray skips on the same site).

Knapweed standing crop was 1,179 lb./acre for the non-sprayed site and forb standing crop (cinquefoil) was 317 lb./acre. Therefore, potential grass production would have been approximately 1,500 lb./acre. This site has the potential to produce a good stand of grass and should be resampled.

Summary:

Spotted knapweed infestation decreases grass production and reduces the number of native forbs. It is not uncommon to have 1/2 million to 2 million knapweed plants per acre on knapweed-dominated sites in western Montana.

The knapweed competes with the grasses and native forbs for water and nutrients which not only reduces valuable forage but also aesthetic quality. For all sites which I studied, grasses quickly improved in vigor with seed production by the second growing season after treatment. The expected increase in grass production from treating areas dominated by spotted knapweed will be about the same as the knapweed kills. Although cattle and elk will consume some knapweed, it is apparent that knapweed-controlled areas are much preferred grazing areas. ◆

"Oliver"

Continued from page 4.

says. "There's nothing magical about any given compound, TORDON 22K included. Vertical or lateral movement are functions of the local environmental and climatic conditions, the properties of the chemical being used and how the material is used or applied on a particular site. It's the interaction of all these variables that determines what kind of movement, if any, can be expected once a herbicide is applied."

Oliver reminds users of pesticides to be aware that issues involving groundwater quality, leaching, mobility in soils and other human and environmental concerns are not limited to herbicides such as TORDON 22K. The potential problems and benefits must be considered with all pesticides and all other types of vegetation control.

"You can't just look at one chemical and say that it's always going to be a problem, or that one material is going to move and another is not," he says. "There are many variables involved and they may be unique to each different use or location." ◆

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