

# Management of Russian Knapweed in Nevada

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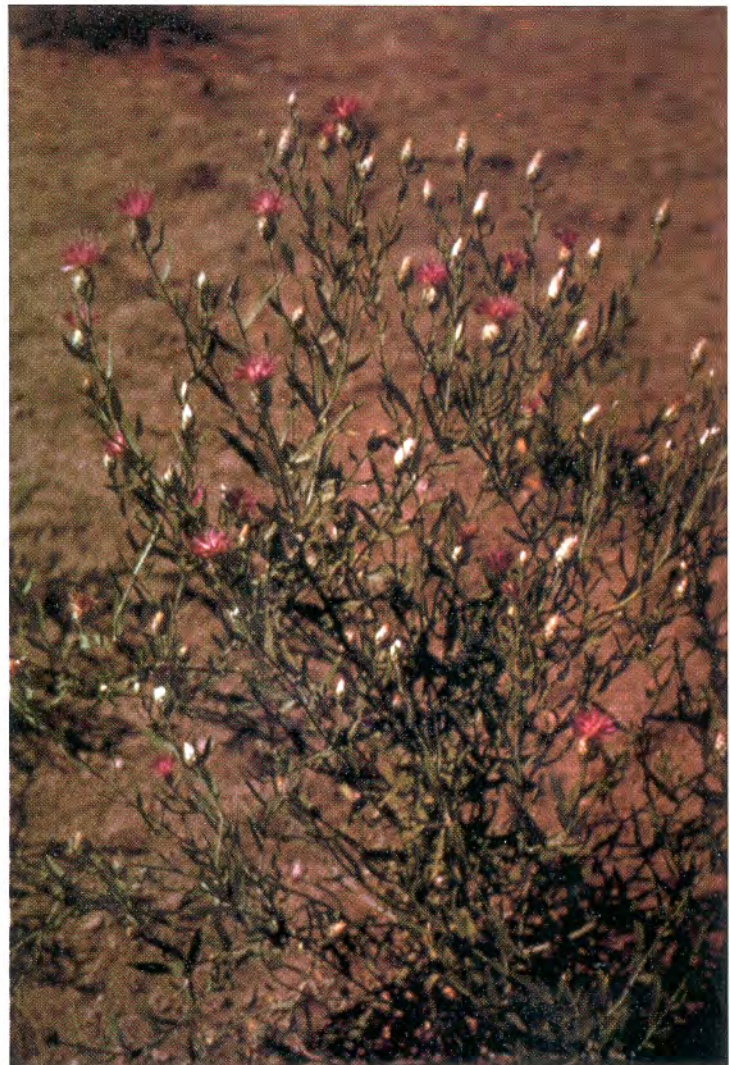
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SP 98-09

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## **Characteristics of Russian Knapweed**

Russian knapweed is a deep-rooted, perennial weed threatening Nevada's crop and rangelands. Nevada may not yet have many acres of Russian knapweed compared to surrounding states, however, they are increasing. Once established Russian knapweed is very difficult and always expensive to control. The old saying, "An ounce of prevention is worth a pound of cure," is appropriate in managing this weed. If action is not taken when the weed first starts, its control becomes very expensive later. Control is so difficult it may be uneconomical to raise alfalfa hay in Nevada where Russian knapweed infestations occur.

Russian knapweed is found in most parts of the state, including southern Nevada. It thrives on rangeland and irrigated ground. It often invades degraded areas and dominates remaining plant communities. Russian knapweed invaded cropland that was abandoned for lack of water during the drought of the late 1980s and early 1990s, particularly in the Lovelock area. Often it is found around old buildings and growing on disturbed ground. Russian knapweed prefers sites that have higher precipitation such as drainages, riparian zones that are not excessively wet, river bottoms, irrigated fields and runoff areas. However, once established, Russian knapweed is extremely drought tolerant.

Russian knapweed spreads primarily through vegetative growth and secondarily by seed. Its crown and rhizomes (underground shoots) produce new plants. This allows the plant to spread quickly. Its root system actively competes for water and nutrients and reaches depths of eight feet or more. Its roots are brown or black and have a scale-like appearance, which can be seen near the crown or soil surface. Roots and rhizomes from a Russian knapweed plant expand rapidly and may cover up to 12 square yards in two growing seasons (Beck 1996). From a small patch if left unchecked, it can dominate hundreds of acres. Since Russian knapweed spreads mainly from its rhizomes, it will grow in a circular pattern.

Russian knapweed is allelopathic. The plant produces phytotoxins (plant toxins) that interfere with the establishment and growth of neighboring species. Extracts from Russian knapweed decrease the germination of seeds of other species (Hanson 1990).

It is not uncommon to have monocultures, or sites completely dominated by Russian knapweed. It will out-compete other species in the area resulting in 90 percent or more of the total plant biomass (weight) grown on the site being Russian knapweed. This results in a shift in the food available and consequently a change, a decrease, in the wildlife that is normally seen in the area.

Russian knapweed is unpalatable to livestock and wildlife in many stages of its growth. If animals are forced to eat it, it can be toxic especially to horses (Young 1970). Cattle and sheep will graze Russian knapweed in the spring when it is young and tender; however, if other plants are available, they will graze them first. When grazing is heavy or overgrazing occurs, desirable plants become stressed, giving Russian knapweed a competitive advantage.

## Control of Russian Knapweed: Integrated Methods

*"I spent the first half of my career trying to kill weeds, I spent the second half trying to replace them with a more desirable plant"* Tom Whitson, Extension Weed Specialist, University of Wyoming

No one method alone will not result in satisfactory control of Russian knapweed. First, use an appropriate herbicide. Research showed Russian knapweed stands are not substantially reduced unless an effective herbicide is used (Bottoms 1996). Second, revegetation with an adapted perennial plant to replace Russian knapweed. Without competitive plants, Russian knapweed will reinvaded a site. A perennial plant competes for sunlight, water, and nutrients with Russian knapweed. Perennial grasses are preferred as competitive plants over broadleaf plants (forbes, shrubs and trees) because they tolerate herbicides that are effective against Russian knapweed.

Research has examined the effects of mowing and tillage as control methods for Russian knapweed. Tilling the weed without the help of a herbicide did not reduce the stands, and in some cases increased the canopy cover (Bottoms 1998). Russian knapweed has buds on its crown and rhizomes that result in more shoots and new plants after tillage. Furthermore, tillage eliminates competition from existing grass plants. Mowing done weekly results in satisfactory control, but is not practical or economical in most cases, particularly on rangeland.

### Herbicides

The herbicide to use for controlling Russian knapweed depends on the situation. Things to consider are:

- Whether the field irrigated is or not
- What you intend to plant in the field in the future
- Soil type (is it sandy?)
- Cost of the herbicide
- Does the applicator has a applicator's license.

Several herbicides have shown their superiority in controlling of Russian knapweed - picloram (Tordon<sup>®</sup> and Tordon 22K<sup>®</sup>) and clopyralid (Stinger<sup>®</sup> or Transline<sup>®</sup>) or (Curtail<sup>®</sup> [clopyralid + 2,4-D]).

**Picloram (Tordon<sup>®</sup>)** effectively controls many broadleaf weeds and woody plants. It is a restricted use herbicide. To buy and use a restricted use pesticide in Nevada, the applicator must have a private or commercial applicator's certification or license, or be under the supervision of someone who has one. For information on obtaining a certification or a license contact your Cooperative Extension office or the Nevada Division of Agriculture.

Picloram is the herbicide of choice for controlling Russian knapweed if the following conditions are met:

- 1) There is a registered crop on the label or the area is not cropland.
- 2) The site of application is not flood or subirrigated lands.
- 3) The site does not have rapidly permeable soils (sand or sand-based).
- 4) The site does not have exposed bedrock substrates that allow direct access to groundwater.
- 5) Broadleaf plants will not be grown on the site (example: alfalfa).

If the site conditions are met, research indicates an average of 87 percent control of Russian knapweed five years after the initial treatment with picloram (Bottoms 1998). A primary advantage of picloram is that it has good soil residual (long half-life). It stays active over an extended period and maintains long-term control of Russian knapweed. The length of time that picloram remains active in the soil depends upon the soil type, amount of precipitation and the microbial activity.

To control Russian knapweed, use 1 to 3 quarts per acre. If applied in the fall, the lower end of the recommended rates will provide excellent control. Since the weed usually grows in patches, spot treating will result in a lower cost per acre. Annual spot retreatments will be needed 2 to 3 years after the initial treatment.

When Russian knapweed has out-competed other plant species, then grasses will need to be established for long-term control. Seedling grass plants can be sensitive to picloram and may not establish for two months after application. Since the weed must be controlled before perennial grasses can be successfully established, in this case, clopyralid is a better alternative.

*Clopyralid (Stinger<sup>®</sup>, Transline<sup>®</sup>, and Curtail<sup>®</sup>)* although slightly more costly, is a viable alternative for the control of Russian knapweed. Clopyralid is not a restricted use pesticide. It has several advantages over picloram.

- 1) It can be used on irrigated pastures or meadows, although it cannot be directly applied to water
- 2) Clopyralid has only a 30-day waiting period after application before perennial grasses can be established.
- 3) Legumes or broadleaf plants can be planted 10 1/2 to 18 months after application of clopyralid or the following growing season, depending upon the product used, the crop to be seeded, soil conditions and state. For example alfalfa can be planted 10 1/2 months after the application of Curtail<sup>®</sup>.

However, Clopyralid does not have as long of a soil residual as picloram, thus re-treatment will be needed and more frequently. Annual spot re-treatment will be needed 1 to 3 years after the initial application.

Transline® and Stinger® are labeled at 1 to 1 1/3 pints per acre to suppress Russian knapweed. Apply at the bud to mid-flower growth stage or treat in the late fall. Transline® is used for control of Russian knapweed on non-croplands only. Restrictions for applying clopyralid products where they can contaminate groundwater are the same as those that apply to picloram.

Labeled rates for Curtail® for control of Russian knapweed are 3 to 4 quarts per acre. If Curtail® is applied in late summer or fall, then three quarts will provide adequate control of Russian knapweed. Research show 98 percent control of Russian knapweed by Curtail® in the first year after herbicide application (Benz 1998). Following an initial application, and a re-application of Curtail® two years later, Russian knapweed was 80 percent controlled five years later. (Bottoms 1998).

### **Timing of Applications**

Treatment of Russian knapweed is most effective in the fall. Control of the weed with Tordon® and Curtail® has been 94 to 99 percent effective when the herbicides were applied at the bloom stage of the plant or later (Swearingen 1994). Treatments are effective from late summer into the fall, but are most effective after the first frost. Date of first frost depends upon your location in Nevada; however, for much of the state this occurs early to mid-October. If you do not have frost, treat after the bloom stage, preferably in the fall. Spot treatment of outbreaks will need to be done yearly in the fall for full control.

## **Control of Russian Knapweed on Irrigated Cropland**

Russian knapweed is a serious problem in cropland, it significantly reduces economic returns. Hay buyers refuse Russian knapweed infested hay. It lowers the quality of hay as feed, and there is the risk of establishing it on the buyer's farm or ranch. Likewise, seed companies do not want Russian knapweed in alfalfa seed fields. Complete cleaning is very expensive and it's almost impossible to remove every knapweed seed. Therefore, it is important to keep Russian knapweed out of alfalfa and controlled at the edges of the field or it will move into the crop where treatment is more difficult. Always clean equipment that has moved through infested areas where mature Russian knapweed seed is present before going to an uncontaminated area.

Alfalfa or other broadleaf perennial crops should not be planted in a field where Russian knapweed is present. Planting a perennial crop is a big investment, and there is little you can do to control Russian knapweed in a broadleaf crop like alfalfa. Every effort should be made to make sure that Russian knapweed has been eliminated **before** the perennial crop is planted.

### **Treating Russian Knapweed in Existing Alfalfa Seed, Hay or Broadleaf Crops**

If Russian knapweed is a problem in an irrigated field, the best way to get it under control is to plant a rotation crop of small grains or grass that can be treated with clopyralid. In a field where these are planted, Russian knapweed can be treated with clopyralid with little



or no damage to the crop. Treatment may need to be done for several years to get the weed completely under control. Keep in mind that alfalfa cannot be seeded for 10½ months after the application of Curtail®.

If Russian knapweed is in established stands of alfalfa seed, hay or other broadleaf crops, it is best to spot treat. Examples include spot treatment with a handgun or sprayer, wiper or sponge applicator, or in selected cases wick applications when the Russian knapweed stands higher than the crop.

No herbicide will selectively take Russian knapweed out of a broadleaf crop without damaging the crop. In an established crop, the best alternative for controlling Russian knapweed is with a non-selective herbicide like glyphosate. Roundup Ultra® is labeled for spot treatment of knapweed in alfalfa and other perennial crops. It should be applied as a two-percent solution after Russian knapweed blooms, but before seeds mature.

Care must be taken during application, as glyphosate is a non-selective herbicide that will kill alfalfa and other crops. It is best to use wipe or sponge applications applied directly to the Russian knapweed avoiding the crop plant. If a sprayer is used, treat as small an area as possible, and re-seed after treatment. Wait three days after treatment before re-seeding. If you do not re-seed after treating with glyphosate, Russian knapweed or other weeds will invade the bare site.

Hexazinone (Velpar®) may provide some suppression of Russian knapweed in alfalfa, however control will be limited. If Russian knapweed is a problem in alfalfa it is an indication that the stand needs to be re-established.

### **Long-Term Control of Russian Knapweed on Rangeland or Pasture Using Grass**

The key to controlling Russian knapweed is to stress the weed and cause it to keep expending nutrient stores in its root system. Long-term control of Russian knapweed can be obtained through vigorous competition from perennial plants in combination with the correct herbicide. Without vigorous competition Russian knapweed quickly reinvades.

To achieve control, it is important to understand the various stages of Russian knapweed infestation. If soil, precipitation and grazing practices are favorable, Russian knapweed can dominate an area. During early infestations or with moderate competition, Russian knapweed and grass may both be present. If there is still a good understory of grass, using picloram or clopyralid will release the grass, which will expand as the Russian knapweed declines. Rhizomatous grass species work best. If bunch grasses are present, they should be dense enough to fill in as the Russian knapweed diminishes. When grasses are given the competitive edge they provide long-term competition and control of Russian knapweed. It is important to remember that management must favor the grasses and not Russian knapweed. Do not overgraze Russian knapweed infested sites.

If the site is completely dominated with Russian knapweed and there is no understory of grasses, then perennial grasses must be established to obtain satisfactory long-term control. Several factors must be considered when establishing perennial grasses in Russian knapweed infested areas:

- 1) Control Russian knapweed with an herbicide to help decrease competition to the new seedling grass plants
- 2) Timing and method of planting the grass.
- 3) Type of grass to establish, use the most competitive species adapted to the site.

### **Timing and Method of Planting**

Tillage of an area that is infested with Russian knapweed prior to seeding a grass species is needed. The litter of Russian knapweed has an allelopathic effect that inhibits germination of seeds. Drill seeding the desired grass will result in a better stand at a lower seeding rate than broadcast seeding. If the terrain is not too steep, rocky, or hard, then a regular grain drill can be used. If the area is rough, then a no-till or rangeland drill must be used.

Dryland grass species should be planted in the late fall, preferably late October or early November. The goal is to plant the seed when it is cold enough that the seed will not germinate, but early enough that the ground is not frozen and it is still easy to drill in seed. Late fall plantings are highly recommended, as they will greatly increase the probability of successful establishment of the stand over a spring planting. Dryland species seeded in the spring are usually planted too late to take advantage of early spring moisture and growing conditions.

### **Type of grasses to plant**

There are many varieties of grasses that can be used in Nevada to successfully compete with Russian knapweed. The amount of water a site receives is the single most important factor in choosing a grass. You should also consider your intended use of the area, the price and availability of the seed, the soil type-its alkalinity and salinity, and the ease of establishment.

**Crested Wheatgrass** is the grass most commonly seeded on Nevada rangelands. It has one of the best track records for establishing and growing on our arid range sites. It is competitive against cheatgrass, Russian knapweed and other weeds. The seed is usually the least expensive of dryland plants. Crested wheatgrass shows good drought hardiness. It will establish and grow well on sites with as little as eight inches of precipitation. Varieties of crested wheatgrass often used include '*Nordan*', '*Hycrest*', or '*Ephraim*'. One disadvantage of crested wheatgrass is that it decreases in palatability after forming seedheads.

Crested wheatgrass is the most practical grass for spring grazing because of its ability to green up early and its high tolerance to spring grazing. Caution, overgrazing in early spring or removal of greater than 50 percent of the crested wheatgrass can result in a stand loss and eventual return of Russian knapweed.

In studies where grasses were used as competition against noxious weeds, crested wheatgrass resulted in the highest percentage of grass cover and biomass harvested. During the summer of 1994 (a drought year), plots were clipped, weighed for production per acre and analyzed for total digestible nutrients (TDN) and crude protein (CP). Crested

wheatgrass resulted in the highest production per acre with 1,829 lbs of dry matter produced. It also yielded the most pounds of TDN and CP per acre (Whitson, 1994).

**Siberian Wheatgrass** has many characteristics similar to crested wheatgrass. It greens up early in the season like crested wheatgrass; however, it stays green slightly later in the season, allowing more flexibility in grazing. Siberian wheatgrass has good track record for establishing on Nevada rangelands, and has good tolerance to spring grazing. It will establish on sites similar to crested wheatgrass in the eight-inch precipitation zone and is slightly more drought tolerant. Varieties showing excellent establishment and competition on weedy sites include 'Vavilov', 'P-27', and 'PI-275459' (St. John 1997). The seed is usually more expensive than crested wheatgrass seed, often double in price.

**Russian Wildrye** is not often used on Nevada rangelands due to its reputation of being hard to establish. Newer cultivars are overcoming this difficulty. '*Bozoisky-Select*' has improved seedling vigor and higher establishment rates than other cultivars. The seed is more expensive than crested wheatgrass. It will grow in ten-inch precipitation zones, but prefers 12 to 13 inches of moisture. Due to its preference for higher precipitation, Russian wildrye may be a good choice for run-off drainage areas and along roadsides.

One advantage of Russian wildrye is it has excellent season-long palatability. The wildryes in general maintain a higher level of crude protein (CP) than do the wheatgrasses. A difficulty with Russian wildrye is that it is so palatable to livestock that it is very easy to overgraze. Livestock will literally "slick it off". It is best to use Russian wildrye for fall grazing after it has already produced seedheads and had time to store carbohydrates in its roots. It is not recommended to mix Russian wildrye with other grass species and graze in the summer, as livestock will selectively overgraze it.

Russian wildrye should be seeded at a rate 6/lbs PLS/acre on 24-inch rows. It is extremely competitive with other grasses or weeds once established, as long as it is not overgrazed. Even with wide rows and some bare space between rows, weeds do not establish due to a very competitive root structure.

## **Impacts From Grazing on Russian Knapweed Control**

The impacts of grazing will largely depend upon the timing of the grazing, the amount of grazing and the livestock species used. Anytime desirable plants are heavily grazed and Russian knapweed is left ungrazed, knapweed gains a competitive advantage.

Cattle tend to utilize grass over forbs or shrubs. Although they will graze Russian knapweed at certain times of the year, they will heavily graze the grass before grazing Russian knapweed. The goal is to give the competitive grass the advantage while stressing Russian knapweed. Thus it is important to carefully monitor the grass for utilization. A good rule of thumb, take half of the plant (grass) and leave half. This will give the grass a chance to continue photosynthesis (production of food) without taking energy out of its carbohydrate reserve.

Sheep and goats are used to maintain and control many rangeland weeds. Sheep have a muscular pad in their upper jaw (rather than teeth), a cleft upper lip, and a relatively

narrow muzzle which allows them to take small bites and select specific parts of a plant to eat (Arnold 1978). Unlike larger ungulates, sheep can harvest prostrate plants, strip leaves from branches, break and chew twigs and pick off individual leaves (Olson 1994). Extensive research has not been done to study sheep and goats as a control tool for Russian knapweed. Observation of grazing sheep and goats show that they will graze the plant. However, one must keep in mind the objective of causing external stress on the Russian knapweed, to the advantage of the competitive grass. Sheep and goats are not likely to kill the Russian knapweed plant and should be used in combination with herbicides and competitive grasses.

#### **Impacts From Early Season Grazing**

In the spring, grasses are at their peak nutritional value and palatability for animals. At the same time, Russian knapweed is rapidly growing, but it is less palatable to animals than grass. Thus, spring grazing will result in livestock grazing the grasses more heavily than Russian knapweed. This gives Russian knapweed a competitive edge over the grasses, especially if the grasses are heavily grazed.

As grasses first begin to grow in the spring, they use carbohydrate reserves stored in their roots. After the grass reaches 4 to 6 inches of vegetative growth and has grown green leaves it takes sunlight and replenishes carbohydrate root reserves. As long as the grass is not too heavily grazed or disturbed, it continues to put energy into the root system until it starts into the boot stage, or the stage of producing seed. As grasses pass through the late vegetative stage into seed head production, stored energy is removed from the root system to set seed. If grasses have been heavily grazed in the early vegetative stage or near seed production, the reserves of energy in the roots will be deficient. Reduce grazing pressures at both these times to improve their competitive edge over Russian knapweed.

#### **Impacts From Late Season Grazing**

Once grasses have set seed, they replenish carbohydrate root reserves. Grazing in late summer or fall is less likely to cause stress on the grass. To provide the grass a competitive edge, grazing should be delayed until later into the summer or fall on sites that are heavily infested with Russian knapweed.

### **Summary**

Long-term control of Russian knapweed can only be achieved through integrated weed management. This includes the use of the most effective herbicide applied at the right stage of Russian knapweed development. It also includes competition from a desirable perennial grass and management of grazing that favors the grass. Difficult sites for Russian knapweed control will need annual spot retreatments with an herbicide one to three years after initial treatment (Bottoms 1996).

Points to Remember:

- Russian knapweed is an aggressive invader

- If Russian knapweed is not controlled when first established, control will be much more expensive later as the weed becomes better established and the number of acres infested expands.
- Control requires the use of an effective herbicide (picloram or clopyralid) and competition to the Russian knapweed from a desirable, perennial plant.
- Russian knapweed should be controlled in irrigated fields **before** broadleaf plants such as alfalfa are planted.
- Control in irrigated fields may require growing small grain, grasses or other compatible plants with clopyralid while you are getting Russian knapweed under control.
- Glyphosate can be used to spot treat Russian knapweed in fields that are already established in alfalfa or other broadleaf plants and have Russian knapweed in them. Care must be taken to minimize the application of glyphosate on the alfalfa or other plants. Re-seed the area after treatment
- Care should be taken to control Russian knapweed on the edges of fields.
- Grazing should be managed so that desirable plants are healthy and competitive.
- Spot treatment with herbicide will be needed annually until the weed is completely under control.

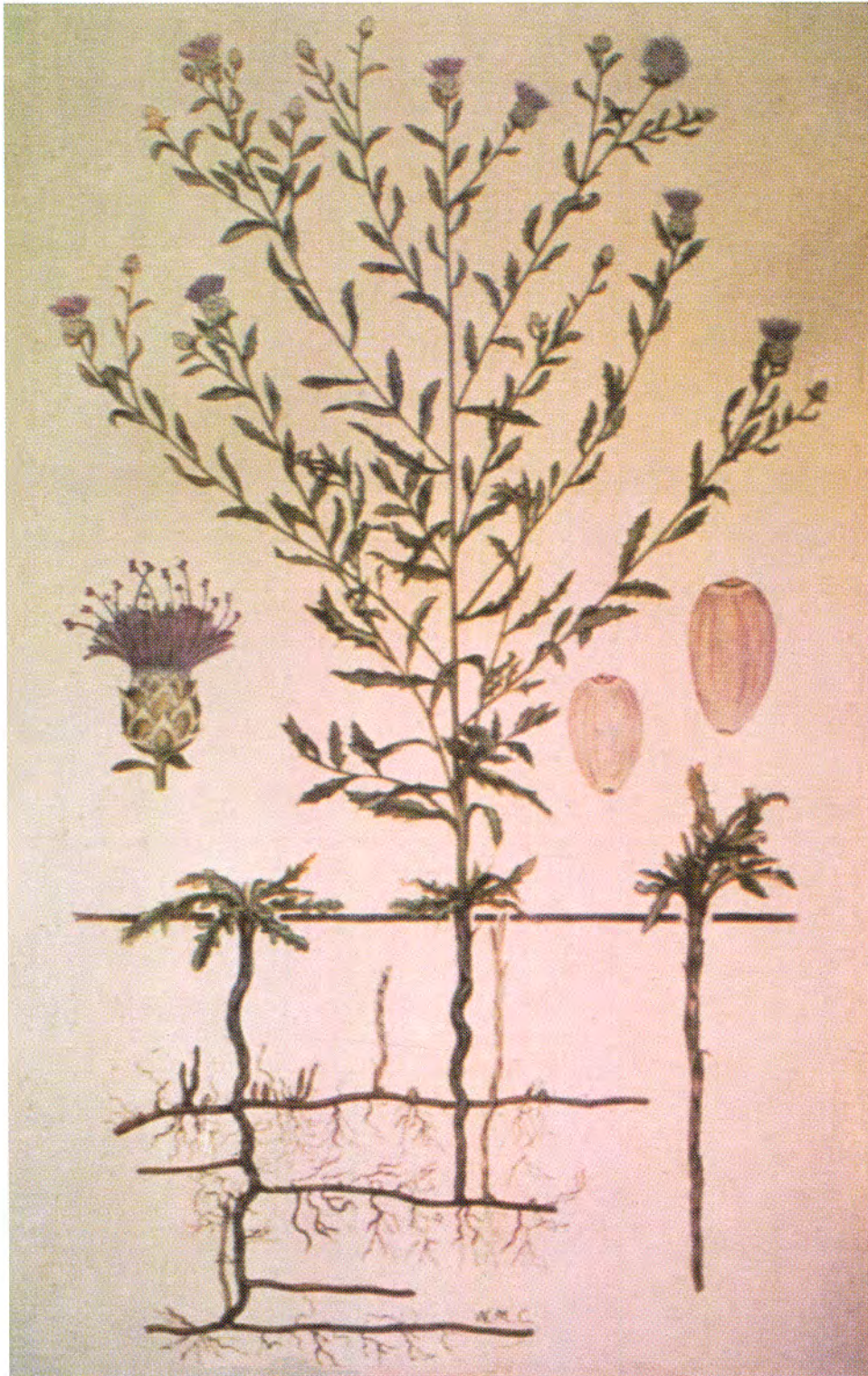
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**Russian knapweed seedhead**

## Russian knapweed



Russian knapweed with mature root structure