GENERAL FORAGE MANAGEMENT

PLAN YOUR CROPPING SYSTEM

Long range planning of a total cropping system can provide you with increased returns, reduced risk, a more stable forage supply and different forage qualities to meet the needs of different classes of livestock. Planning a cropping system involves assessing your land base and existing crop (age of stands, types of crop, need for reseeding) identifying problem areas (such as rocks, poor drainage, saline areas) and availability of irrigation. You also need to determine your forage requirements: amount and type of winter feed, need for spring or fall pasture, early weaning and/or cash hay sales.

When you have completed an assessment of what you have and what your forage needs are, you can begin to plan a crop production system. Your planning should be for a minimum of 5 years, as this is the typical length of a stand of irrigated alfalfa, which forms the basis of most forage systems in this area.

Two cropping systems that are commonly used in this area are:

1 .Continuous alfalfa, five year cycle, with 20 per cent reseeded each year to alfalfa with or without a cover crop.

2. A five year cycle, with one-half of new seeding area in annual crops, used to break the continuous alfalfa cycle.

If 20 per cent of your land is reseeded each year, 10 per cent (or one-half of the new seeding) would be seeded to annual forages (e.g. barley/annual ryegrass) and 10 per cent (i.e. the other one-half of new seeding) would go back to alfalfa and a cover crop, if desired. Under this system, a break to the alfalfa production would occur every 2nd cycle (10 years).

By reseeding on a planned basis (e.g. 20 per cent each year) you will have mixed age stands which offer a number of advantages: more uniform total forage production, reseeding a smaller amount each year rather than a large area every 5 years, reduced risk of winter injury, as young stands tend to be more tolerant of harsh winter conditions, and a place to use as a winter feed ground, thus con- centrating manure on the area to be reseeded.

Including annual crops, such as barley-annual ryegrass or corn, provides a number of advantages, including better weed and disease control, improved establishment of subsequent alfalfa seedings, more flexible grazing management, and a source of high quality, non-bloating fall pasture that is excellent for weaning calves early or finishing lambs.

FORAGE MIXES

Irrigated Hay or Silage Mixes

Alfalfa-Grass

Most forage producers do not grow alfalfa in pure stands, but include some seed of a grass species with the alfalfa seed at planting time. Typically the grass seed will make up 15-25 per cent, by weight of the seed mix. Some of the advantages of including a grass in with the alfalfa include extending the life of a stand if the alfalfa suffers from disease or winter injury, reducing bloat risk somewhat when fall pasturing, reduced drying time in the swath and a hay mix that is better suited to the nutritional demands of beef cattle.

Some of the disadvantages of grass legume mixes are differences in maturity, such that one species is ready to harvest before the other; different fertilizer requirement for each species; and reduced options for weed control.

No definite impact on yields has been substantiated, with some studies showing higher yields for grass legume mixtures, while others show a yield advantage for pure alfalfa stands.

Commercial hay producers indicate there is a market demand for a variety of hay types, with pure alfalfa or timothy usually bringing the best price. Other niche markets include the horse

industry or dairy producers (e.g. low potassium hay). See tables on forage species description in this manual for specific characteristics and adaptability.

Recommended mixes for Zone 1 (3 cuts) would include up to 25 per cent by weight of orchardgrass or tall fescue with the alfalfa, although pure alfalfa seedings are common in this zone. When selecting orchardgrass varieties to plant with alfalfa, later maturing varieties are preferred, so that their growth stages match alfalfa growth. Winter hardiness is also of concern as many varieties of orchardgrass will winterkill in this district.

In Zone 2 (2-3 cut areas) orchardgrass is also the most common grass in a mix, but other species, such as timothy, smooth brome, tall fescue, intermediate and pubescent wheatgrass can also be used successfully. Again, choosing late maturing varieties, when available, is recommended. orchardgrass provides the best re-growth after the first cut, whereas timothy, brome and pubescent wheatgrass contribute most of their growth in the first cut, with less re-growth later in the season. Tall fescue yields similar to orchardgrass, but has improved quality in late fall and winter. These species are less competitive with the alfalfa than orchardgrass and may be desired for this reason. Smooth brome and timothy are very winter hardy, whereas intermediate and pubescent wheatgrass are somewhat less hardy.

In Zone 3, winter hardiness becomes a more important selection criteria, therefore smooth brome or timothy are recommended in these areas. Other grass species may be used to fit your particular requirements.

Dryland Mixes

Dryland pasture mixes and range mixes are normally seeded at lower rates (under 10 lb./ac) as moisture is limiting and fewer plants can be supported. Selection of species for dryland pasture is determined by the amount of moisture that is available. For areas receiving less than 12 inches of precipitation a year, crested wheatgrass is the preferred species. Although alfalfa has frequently been included with crested wheatgrass, persistence in the stand is often poor, and may be related to grazing practices. Other grass species that have been seeded with some success in these very dry areas include hard fescue and Sherman big blue grass. Hard fescue may be the best alternative to crested wheatgrass but is slightly later and less palatable in spring. Sherman big blue is considerably lower yielding than fescue or crested wheatgrass.

Only very limited success has been achieved with seedings of altai and Russian wildrye, which have had poor establishment and survival in this region, and are not generally recommended.

In areas of higher precipitation (greater than 12 inches per year) a number of other species can be grown satisfactorily. Pubescent and intermediate wheatgrass, orchardgrass, smooth brome and meadow brome may be considered for these areas of higher precipitation.

SOILS AND FERTILITY MANAGEMENT

Forage crops respond to good management. Correct fertility management combined with proper species selection and irrigation practices can result in yields of 6 to 8 tons per acre in the Kamloops area.

To develop a fertility program a good knowledge of soil properties is required. Fertilizer choices need to be based on soil tests as the proper balance of nutrients is often more important than the level of nutrients applied. Continuous cropping will then result in the depletion of mineral nutrients. It is quite likely that one or more nutrients will become deficient even on fertile soils.

Soil Tests

Soil sampling is not required every year on all fields. A first priority for soil sampling are those fields to be re-seeded. On established forage stands samples can be taken every second or third year to monitor nutrient levels.

Fall sampling is preferred since test results will be available in plenty of time to make decisions

regarding spring seeding and fertilization. It is important that soils that are to be seeded to forage
crops be tested for N (Nitrogen), P (Phosphorus), K (Potassium), Ca (Calcium), Mg (Magnesium), as well as B (Boron) and S (Sulphur).

When fertilizer is applied, on-farm test strips are recommended to provide a visual response to fertilizer on your farm.

Soil Sampling

Detailed information on how to take soil samples is available at Ministry offices. It is especially important that the samples taken be representative of the field being sampled. For this to occur it is recommended that 20 to 30 small samples be taken a depth of 6 inches from the field to be tested. These are then mixed together well; air dried, and approximately one pound is taken for analysis.

Information on laboratories that provide soil analyses is available at Ministry offices.

Soil pH, Soil Organic Matter, Nutrients

Soil pH

The pH of a soil is a measure of its acidity (less than 7.0) or alkalinity (higher than 7.0). Most soils in the Kamloops District are neutral to basic (pH 7.0 or higher) with the exception of areas in the North Thompson which are slightly acidic.

The pH level of a soil has a significant effect on the availability of nutrients. As pH levels drop below 6.0 the availability of plant nutrients such as nitrogen, phosphorus, potassium, sulphur and magnesium become less available. Alternatively as the pH levels rise higher than 7.5 the availability of nitrogen, phosphorus, manganese, boron, copper and zinc is reduced.

Of particular importance to alfalfa production is the effect of low pH soils on the survival of rhizobia. As values drop below 6.0 the growth of alfalfa rhizobia is reduced resulting in lower nitrogen fixation and lower yields.

Soil Organic Matter

The organic matter content of most mineral soils in the Kamloops area range between 3 and 5 per cent. Organic matter is an important component of soil as it improves the physical condition, increases soil moisture holding capacity, improves aeration, and serves as a source of nitrogen and other plant food. It also supports bacteria and fungi, which aid in the release of plant nutrients.

Practices that maintain and replenish organic matter include the application of manure and production of green manure crops. The addition of straw, shavings and sawdust will also increase organic matter levels, however these materials generally require the addition of supplemental nitrogen to encourage breakdown. If you are using these materials a level of 30 pounds of actual nitrogen per ton of materials is suggested.

The following table (Table 1) provides the approximate levels of nutrients in manure that contains a normal quantity of bedding or litter.

Table I **Nutrient Levels in Manure**

	Percent Moisture	Pounds Per Ton* N	P2O5	K2O
Dairy	86	11	3	10
Sheep	68	20	15	8
Steer or Feed Yard	75	12	7	11
Horse	80	13	5	8
Poultry	51	43	58	26

*as applied

When applying manure the rates should not exceed crop uptake levels.

Nitrogen (N)

The requirement for nitrogen will vary depending on the crop to be grown. Properly inoculated legumes such as alfalfa will fix large quantities of atmospheric nitrogen. Nitrogen is

seldom required on pure stands of alfalfa except at time of seeding, as a starter effect in early spring and on soils low in organic matter. This provides nitrogen for rapid growth of the alfalfa seedlings until nodules form on the roots and the rhizobia are able to fix nitrogen.

On mixed stands of grass and legume, as the legume component in the stand decreases the addition of nitrogen is required if yields are to be maintained. If a stand is 50% or more legume, no nitrogen fertilizer is generally required.

The recommended minimum soil test level for nitrogen is 15 ppm with additional amounts required depending on the crops to be grown. High soil test levels (greater than 75 ppm indicate excess nitrogen in the soil, and may result in nitrate leaching. Contact an Agrologist to discuss appropriate management).

Phosphorus (P)

Phosphorus stimulates early growth and root formation. It also hastens maturity and promotes seed production.

Phosphorus is most soluble in soils at a pH level of 6.0. As pH levels go above and below this level phosphorus becomes less available. Phosphorus tends to move very slowly through soil when compared to other nutrients. Under cool conditions there is less uptake of phosphorus by the plants. Purplish coloration on foliage is one sign of a phosphorus deficiency, which can also show up under cool conditions even when soil levels are adequate.

The recommended minimum soil test level for phosphorus is 30 ppm. Levels below this may result in reduced crop yields.

As phosphorus movement in soils is very slow applications can be made annually or heavier rates applied over longer periods of time. On new seedings phosphorus can be incorporated into the soil prior to planting.

Potassium (K)

The potassium content of forages can be very high with levels exceeding 2.5 per cent in alfalfa grown in the Kamloops area. Potassium levels in many soils in the Kamloops area are adequate. An exception is on light, sandy soils in the North Thompson Valley, which are often low in potassium. When the potassium levels are reduced alfalfa stands can degenerate to grasses and weeds as grasses are able to "out-compete".

The appearance of white spots along the margins of alfalfa leaflets is a classical indication of potassium deficiency. If the deficiency is discovered soon enough, it can be corrected without any severe crop losses.

Studies have indicated that adequate potassium levels contribute to the persistence of alfalfa in a stand. Winter hardiness and the ability of the plants to endure moisture and temperature stress are improved with adequate potassium levels.

The recommended minimum soil test level for potassium is 150 ppm. When potassium is required, application by top dressing on established stands is practical. The plants recover most of the potassium applied this way.

Sulphur (S)

The sulphur content in most soils in the Kamloops area is adequate. The areas where deficiencies are noticed are in the higher rainfall areas. Deficien- cies of sulphur have similar symptoms to nitrogen deficiency - pale yellow or-light green leaves. Sulphur is an important element as it is one of the components of protein.

The recommended minimum soil test level for sulphur is 20 ppm. Caution should be taken when applying sulphur as continuous applications over a period of years will reduce soil pH levels. Tissue samples may also be required to confirm soil sulphur levels.

Boron (B)

Boron is a common deficiency in most soils in the Kamloops area. The levels required by plants are very low with one ton of alfalfa containing only one ounce of boron. Despite such a low requirement by the plant a deficiency can cause a serious reduction in crop yield.

One of the most important functions of boron is in the movement of carbohydrates in the plant. The most rapid movement will occur at the growing points of the plants and this is where the first signs of a deficiency will show. Under dry or cold conditions boron deficiency will be more evident and the leaves at the growing points of alfalfa will turn yellow and reddish. The lower leaves will remain green.

Boron deficiency symptoms are more evident in alfalfa than grasses as the requirement for boron in alfalfa is much higher.

The recommended minimum soil test level for boron is 1.0 ppm. Boron can be applied once every two or three years if levels are low. When applying boron it can be premixed, applied through a spray, or spread using a granular formulation such as 'Borate 40' which is 12.5 per cent Boron. Boron should never be applied without a soil analysis confirming deficiency. Excess Born can lead to toxicity.

Fertilizer Terms

The "grade" of fertilizer is expressed as a set of three numbers in order of per cent total nitrogen, (N), available phosphate (as P_2O_5), and soluble potash (as K_2O). A fertilizer such as 5-10-15 contains 5 per cent N, 10 per cent P_2O_5 and 15 per cent K_2O. The remaining 70 per cent of the product consists of other elements such as calcium, chlorine, and oxygen.

With products such as 16:20:0:14, the fourth number (14) represents the percentage of sulphur in the product.

General Fertilizer Recommendations

The most cost- effective use of fertilizer can only be achieved when it is based on a soil test. If a test was not carried out Table II can be used as a guide until such time that sampling is done and the correct balance of nutrients required can be determined.

Table II

Minimum Recommended Soil Test Levels

Nutrient	Soil Test Level
NO_3N	15 (µg/ml)
P_2O_5	30 (µg/ml)
K_2O	150 (µg/ml)
S	20 (µg/ml)
B	1 (µg/ml)

NOTE: (µg/ml=ppm

Table III	Fertilizer Guide				
	Plant Food Requirements Kilograms Per Hectare (Pounds Per Acre)				Comment
Crop	N	P_2O_5	K_2O	S	
Cereals/Grasses	50 (45)	34 (30)	0	0	On irrigated land reapply the same level of nitrogen after the first crop if under-seeded to annual grasses or double cropping cereals.
Alfalfa or Alfalfa/Grass (80-20)	17 (15)	80 (79)	0	0	Apply early in the spring. Boron should be applied at 3 lbs. B per acre if a deficiency was noticed.
Grass/Legume (60/40)	56 (50)	56 (50)			Apply early in the spring. On irrigated land where multiple cuttings are expected reapply 56-84 kg/ha (50-75 lbs./ac) of nitrogen after each cutting.

FORAGE QUALITY MANAGEMENT

Good quality forage provides the nutrients required to meet an expected animal performance. As an example, a medium quality grass hay is an excellent forage for over-wintering beef cows, but high producing dairy cows require early cut high quality legume hay to achieve maximum production.

The quality of the forage by the time it is fed will depend on a number of factors including the type of plants grown, the stage of growth when cut, losses incurred by weathering, harvesting and storage, and the form in which it is fed.

Stage of Growth

The palatability, digestibility and the nutrient con-. tent of a forage will all vary depending on the stage of development of the plant when it was cut. As a crop matures its digestibility (TDN), crude protein, and voluntary intake by animals will all decrease. As shown in Figure 1 as the plant matures, forage quality drops while total yield increases. It is the producers objective to harvest at that stage of growth when optimum nutritive quality and optimum yield are achieved.

Note: TDN (Total Digestible Nutrients) is a measure of digestibility and the energy level in a feed. Forages can range between. 45 and 65 percent TDN