Saskatchewan
Soil Conservation
Association

Soil Facts

Annual Forages

Annual forages can compliment perennial forages or they can be utilized as emergency feed. If annual legumes are used, there are additional rotational benefits with about 25% of the overall nitrogen fixed by the plant remaining in the soil. Utilizing annual forages in a portion of the crop rotation also allows the producer to diversify without taking land out of annual crop production. One drawback to perennial forages in the drier areas of the province has been the lack of production the year it is seeded. An annual forage can provide same-year hay or silage production on its own or as a companion crop with a perennial. There tends to be more flexibility with respect to seeding dates for annual forages than perennial forages.

Many cereal or legume species can be used for annual forages. Some warm season annual crops can be used for forage, grazing or swath grazing. Cool season crops are more suited for hay, silage, grazing or yellowfeed. Non-legumes will require fertilizer, an input that increases the cost of production, but will certainly increase forage production. Annual legumes or a combination of annual legumes and a forage cereal can provide a lower cost option because little or no nitrogen fertilizer needs to be applied.

Companion Crops, Cover Crops or Single Crop

Although research indicates that using a companion crop with a perennial is generally not recommended in the Brown and Dark Brown Soil Zones, the practice has been quite successful in the Black and Gray Soil Zones. If a companion crop is to be used in the Brown or Dark Brown Soil Zone, it is recommended that the seeding rate of that companion crop be reduced by one third or less.

Many producers who seed a companion crop to a perennial like alfalfa, use a cereal like oats, barley or triticale. Less common is the use of an annual legume like field peas. In either case, if using an air drill or air seeder with a conventional style sidebander or paired row opener, seeding can be accomplished in a single pass, direct seeding operation into standing stubble. The alfalfa is seeded through the wing and the cereal or peas down the point. If peas are used as the companion crop, the producer has the added advantage of being able to use Pursuit® if there is a significant weed problem. An applied research study conducted by Wheatland Conservation Area at Swift Current looked at the dry matter yields of pea, three pea/cereal mixtures, and a pea/alfalfa mixture (Table 1). Although the pea/alfalfa mixture had the lowest yield of the treatments, it still had good first year production and resulted in excellent alfalfa establishment the following year.

Table 1: Average dry matter yields and crude protein content of Annual Legumes for Forage, Wheatland Conservation Area, Swift Current, SK, 1998-2000.

Treatment	Yield (lbs/ac)	Protein (%)
40-10/Triticale	6571	16.28
40-10 Silage peas	6447	16.12
Grande peas	4196	17.54
Grande/Barley	4166	16.61
Grande/Oats	4117	17.03
Carneval peas	4055	16.51
Carneval/Alfalfa	3825	17.12

As Table 1 indicates, using a cover crop of field peas with a cereal has been quite successful with good protein content. It should be noted that there was average to well above average growing season precipitation at Swift Current between 1998 and 2000, so yields tended to be at the upper levels. As a low input strategy, no fertilizer was added to the pea/cereal mixtures, but the peas and alfalfa were inoculated. There wasn't much difference in yield except when a variety of long-vined silage peas called 40-10 was used. Silage type peas produce extremely well but will lodge later in the season if left for seed.

A study being conducted by Wheatland Conservation and SSCA at Aneroid, SK (2001-2003) also indicates the trend of 40-10 silage peas producing significantly higher forage yields than the other treatments (Table 2). A secondary benefit of a silage pea was excellent weed control as a result of the dense canopy and competition to the weeds. The only weed control was a pre-emergent burnoff using 0.5 l/ac rate of Roundup. If the annual forage is being removed for hay, weeds are also removed before they can set seed. In keeping with the low input focus of this study, no fertilizer was applied to the treatments.

Table 2: Average dry matter yield of Annual Legumes for Forage or Greenfallow Study, Aneroid, SK, 2001-2003.

Treatment	Yield (lbs/ac)
40-10 silage peas	3665
Grande peas	2788
40-10/oats	2746
AC Greenfix	1524

AC Greenfix is a variety of chickling vetch that was bred specifically as a source of nitrogen for greenfallow. Although it is possible to use Greenfix as a forage, the **seed contains a high level of a neurotoxin, therefore, it is important to remove this crop before it sets seed if being used for forage.** Over the past three years of this study, AC Greenfix did not provide close to the level of weed competition as the pea treatments and always produced the lowest yield of forage, but did tend to have a higher crude protein content than the other treatments. However, a study of AC Greenfix conducted by Dr. Biederbeck (Semiarid Prairie Research Centre, Swift Current, SK) from 1998-2000 in several locations across southwest Saskatchewan, found Greenfix forage yields averaged 2310 lbs/ac with a crude protein content averaging 19.63%.

Cool and Warm Season Annual Forages

Cool season crops are those that can germinate and grow in cooler temperatures. Cereals such as oats, barley and triticale, and legumes such as peas are examples of cold season crops. The millets, including crown, golden German, and prosso are examples of warm season crops. Warm season crops require warmer temperatures to germinate and develop. The optimum growing temperatures for warm season crops are 32-35^{0}C, whereas the optimum growing temperatures for cool season crops are 18-24^{0}C. Potentially, warm season crops can be more water efficient than cool season crops, but only under good growing conditions. Cool season crops also have a different method of photosynthesis. Once they are about five inches tall, they seem to go dormant for some time. However, they undergo all their cell division in this time period and once that is completed, they can grow very quickly because the cells are only elongating. The cells of cool season plants must continue cell division throughout their growth.

Warm season crops do require more management than cool season crops. They are very susceptible to weed pressure during this "dormant" period, which can severely reduce yields. They perform best when seeded into warm, cultivated soil with little trash cover. As a result they may not be best suited for soils with high trash residues.

If the producer intends to swath graze, late maturing warm season crops need to be seeded in early June and can be swathed late in the season. If cool season crops are seeded in early June, there will be a significant reduction in yield. Therefore, cool season crops are better suited for hay, silage or emergency grazing rather than swath grazing.

Although most annual crops can produce high forage yield in wet years some of these same crops don't have the capacity to produce very well under drought conditions (Table 3). Crops, such as peas, cereals and pea/cereal combinations, showed good yields in both wet and dry years. Yields of the cereal/pea combinations have generally resulted in lower forage yields when compared to annual legumes alone, with the exception of AC Greenfix. This is not necessarily a negative, depending on the end use of the forage.

Table 3: Average dry matter yield (lbs/ac) of Annual Forages for Forage, Greenfallow or Seed Study, Wheatland Conservation Area, Swift Current, SK, 2002-2003. Only the yields of the forages are shown in this table.

	German Golden Millet	Faba Bean	Forage Corn	Grande Peas	40-10 Silage Peas	Greenfix	Forage Oats	Forage Barley	Triticale	40-10 /Oats	40-10 /Barley	40-10 /Trit.
2002	6976	6532	6475	2362	2138	1548	2048	1952	2131	1692	1951	1688
2003	854	214	728	1681	2122	1098	2373	2062	1841	1732	1797	1762

Table 4: Cool vs. warm season annual forages. Forage yields (lbs/ac). Wheatland Conservation Area, Swift Current, SK, 2003.

Seeding Date	Forage Oats	Forage Barley	Triticale	CPS Wheat	Triticale /Peas	Crown Millet	German Golden Millet	Mega Green Sudan Grass	Low Input Corn	High Input Corn
May 2	3402	2812	2657	2801	2438	809	1003	378	637	499
June 9	1039	986	1043	803	837	1252	1219	414	731	513

Timing of seeding can also affect the yield of annual forages. As long as there is precipitation later in the growing season, seeding late can result in good forage yields. However, in a drought year like 2003, combined with extended periods of high temperatures, seeding late can severely limit forage yields (Table 4). However, if the producer wants to swath graze, seeding in early June can be effective, particularly when using later maturing, warm season crops. If the growing conditions are hot and dry, the cool season crops such as the cereals and peas will generally be more adversely affected by late seeding than the warm season crops like millet, Sudan grass or forage corn. Unless the growing season has extended late precipitation, cool season crops tend to produce best when seeded early (i.e. late April to early may in the Brown Soil Zone to early to mid May in the Black Soil Zone). Although the results in Table 4 contain only one year's data, it does illustrate the differences between warm and cool season crops when seeded early or late in a dry year.

A similar study at Redvers and Indian Head (Table 5) does not show significant differences in yields between the early and late seeding dates of the cool season crops, likely due to extended precipitation occurring in 2002 (2003 data not available at time of writing). However, the warm season crops tended to produce higher yields with the later seeding date. The longer the fall, the longer the warm season crops can grow, as evident in both Redvers and Indian Head.

Some producers have used annual crops, particularly cereal crops, for grazing once in the growing season before letting the crop mature enough to cut for forage. Research has shown that if the goal is forage hay or silage, there is a serious cost to grazing the crop first. In other words, use the cool season crop for either grazing or for hay, not both. However, some crops like oats or chickling vetch may re-grow after cutting so they can be grazed in years with extended late season precipitation.

Re-cropping Annual Forages

A discussion of annual forages must also look at the effect of the forages on the following crop. If the annual forages are cut by early July, soil moisture from the remainder of the year can be stored. Annual legumes have an advantage over cereals in that they fix nitrogen. While 75% of the total nitrogen fixed is removed with the top growth, 25% remains in the roots in the soil. Therefore, less nitrogen fertilizer will be required for the cereal re-crop. Several factors will affect the yield of the cereal re-crop. The choice of what crop is to be grown the year following the annual forage crop will be influenced somewhat by the forage crop itself. For example, malt barley might be a better choice after a cereal forage crop like oats or triticale to keep the protein levels low. Wheat might be a good choice after an annual legume forage crop to take advantage of potential higher protein levels in the grain.

Grain yields of the cereal re-crop can be variable, depending on the year and the forage stubble into which the cereal was seeded. The study at Aneroid showed a trend that the oats-silage pea mix tended to yield less than the other treatments (Table 6). One year data from Swift Current did not show a similar trend, however, this is likely a result of the year and the percentage of cereal in the pea/cereal mixture. The lower the percentage of cereal in the mixture, the closer the cereal re-crop yield the following year will be to the re-crop yield after peas cut for forage. Surprisingly, the re-crop on pea and Greenfix stubble was very close to those of chem fallow and tilled fallow.

Table 5: Cool vs. warm season annual forage yields (lbs/ac.) at Redvers (South East Research Farm) and Indian Head (Indian Head Agricultural Research Foundation), SK, 2002.

Seeding Date	Days After Seeding	Oats	Barley	Triticale	Prosso Millet	Crown Millet	Siberian Millet	German Golden Millet	Strain R German Millet	White Wonder Foxtail Millet	Sorghum	Faba Bean
Redvers	75	6516	6048	4690	4360	4244	4512					2572
Early	94							5564	4995	4913	4911	
May 17	109							7801	6851	7032	6249	
Late	64	6538	5127	4396	5827	5167	5874					3318
June 17	98							6476	6217	8247	10022	
Indian Head												
Early	75	5096	6166	5156	*	*	*	*	*	*	*	*
Late	71	5404			5431	6115	6470					3947
	85							5506	5426	5388	5903	
	98		5863	4489				7413	6220	6785	6739	

* Due to weed pressure, no crop was established.

Yellowfeed

Another option for producers is yellowfeed. This system involves spraying the cereal crop with a glyphosate like Roundup® to "dry down" the standing crop. The spraying operation occurs at the same crop stage as normal cutting of the annual cereal for forage. After "dry down", the crop can be swathed and baled the same day. Advantages to spraying the forage include eliminating weathering losses in the windrow; preventing the kernels from falling out; reducing leaf drop; enhancing perennial weed control; the windrows do not need to be turned after a rain; the producer can schedule the harvest; and it may be more palatable to livestock. However, some drawbacks include the requirement for a high clearance sprayer;, the added cost of the glyphosate;, and there is no re-growth for fall grazing. However, a lot of acres can be put up in a short time and it allows the producer to choose the time for harvest.

Inputs

There will always be some inputs involved with annual forages. For annual legumes, this generally involves only the cost of inoculant. Non-legumes will require fertilizer. How much fertilizer used will be up to the producer. However, to maximize potential production, the non-legume crops in Table 3 had 120 lbs/ac of 30-15-0-6 sidebanded. The forages in Table 4 had 150 lbs/ac of 30-15-0-6 applied and the high input corn had 260 lbs/ac of 46-0-0. The treatments in Table 5 had 60 lbs/ac N and 20 lbs/ac P_2O_5 applied. Seed costs can be variable, but the millets are often similar in cost to the cereals. In most cases, for the annual forages to be low input and cost-effective, use of bin run seed is an advantage.

Summary

Annual forages can offer more options and flexibility in providing forage supplies. A variety of annual crops can be used for hay, silage or swath grazing. Legume crops tend to be lower input crops and there will be more nitrogen available for the cereal re-crop the next year. Cereal crops can produce excellent dry matter yields for hay, silage or yellowfeed. Warm season crops are an option if the goal is to swath graze. They do require more management and are more suited to the Black Soil Zone. However, some good yields have occurred in the Southwest as well, but at a higher risk than using cereals or peas. Seeding cool season crops like cereals or peas should be done relatively early to take advantage of available soil moisture and cool temperatures in the spring. Warm season crops should be seeded later in the spring, when the soil temperatures are warmer.

Table 6: Durum re-crop yields (bu/ac) on foraged stubble treatments as well as durum grown on chem fallow and tilled fallow treatments. Wheatland Conservation Area, Aneroid, SK, 2001-2003.

Greenfix	Grande Peas	40-10 Silage Peas	40-10/Oats	Chem Fallow	Tilled Fallow
19.30	20.46	19.77	17.39	21.36	21.38

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