ADOPTING COVER CROPS FOR SOIL IMPROVEMENT AND GRAZING

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ABSTRACT

Planting cover crops is an emerging practice in the Magic Valley region of southcentral Idaho. The region is a moderately windy area along the Snake River plain and wind erosion is a factor in soil conservation plans. Soil health is a major initiative advocated by the Natural Resources Conservation Service (NRCS). In an effort to help producers adopt cover crop practices in the Magic Valley region of Idaho, the University of Idaho Extension and Twin Falls Soil and Water Conservation District conducted a two-year multi-species cover crop demonstration project. The project was conducted on several fields throughout the Magic Valley region of south central Idaho to determine cover crop feasibility within existing farming practices and to determine if cover crops could provide an extension to the grazing season as a side benefit to producer's thereby adding animals to the landscape as part of the soil health practices.

Key words: Cover crops, Soil health, Wind erosion, High residue farming, Extended grazing season

INTRODUCTION

The cover crop demonstration program came about because of a desire by NRCS field staff to reduce wind erosion in the Magic Valley region of Idaho. Wind erosion and the associated negative effects on the soil put producers at odds with conservation plans. When producers have EQIP (Environmental Quality Incentives Program) contracts with the NRCS they are required to have conservation plans that identify soil-conserving practices that producers will implement on their farms. New regulations are promoting closer monitoring of farms under contract and penalties, if enforced, are expected to include loss of future payments and possibly the repayment of past conservation payments.

There is no shortage of soil health and cover crop information available to producers. The NRCS has an extensive selection of information on their national and state web sites and there are several conferences held nationally and regionally promoting soil health and offering ways to improve the soil through the use of cover crops. Much of the information comes from the Midwest and upper plains states where the primary moisture source is rain. Barriers to cover crop adoption in the irrigated west include irrigation management within existing cropping and tillage practices.

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Grower management objectives will determine how they adopt cover crop practices. The soil-health objective receives most of the headlines but several other objectives are possible:

- Moisture capture and retention
- Wind protection
- Livestock forage to include fall, winter, and spring availability
- Increasing soil nitrogen
- Decreasing nematodes in sugar beet rotations
- Conversion to no-till
- Conversion to organic production

Not every producer has the same objective and a single cover crop recommendation will not work for every situation.

The purpose of this presentation and paper is to discuss the outcomes and knowledge gained through the two-year multi-species cover crop demonstration study conducted by the University of Idaho Extension. As Extension Educators in the Magic Valley we need the knowledge to help producers adopt cover crop practices as part of a row cropping system that in many cases include sugar beets, potatoes, or both as well as grazing forage for cattle or sheep.

METHOD

The Magic Valley is bisected by the Snake River. Soils tend to be somewhat different on either side of the river, there are several different irrigation districts, some areas use more pivot sprinklers while others use more furrow/corrugate irrigation and elevation ranges from 3,500-4,500 feet. Six on-farm demonstration sites throughout the region were developed so that several different irrigation and production practices could be observed. Producers who participated were asked to do things just as they would on their farms. The only thing that was specified was the seed mix and planting rate. Seeding rates varied depending on whether forage was the primary goal. Small plot study and tightly controlled practices are adequate for research but often producers view small plot research results with suspect as it can be difficult to replicate those results in a production setting. Not all producers participated both years but the project maintained at least six sites both years.

All producers were following cereal grain with the cover crop planting. Most producers planted 15-20 acres of the multi-species mix but some chose to purchase additional seed mix and plant several more acres. Half of the producers used no-till planters and the remainder used conventional drills where at least some tillage had to take place to prepare a seedbed. One producer tilled and then had seed blown on with the fertilizer spreader. Planting dates for the first year (2013) ranged from August 1st-15th. Planting dates the second year (2014) ranged from August 1-the first week in September. The Magic Valley region received record rainfall (4-6”) the first 1 ½ weeks of August 2014 and which delayed all planting until soils dried.

The covers crops were grown until frost killed them and then either grazed, tilled, or left on the field depending on the individual producer’s objective. The one producer that tilled was preparing a sugar beet bed and wanted the material in the ground so that it could breakdown as much as possible. Sugar beets are small seed and require a fine, firm seedbed. Frame samples were clipped from the fields so that yield for grazing could be determined.

SEED SELECTION

Cover crops are diverse and species selections can be a daunting task. There are many benefits from selecting multiple species from grasses, legumes, brassicas, warm season, and cool season plants. Including 8-12 species in a mix is often recommended and online decision tools are available to help with the decision process. The seed mix selected for this demonstration in 2013 included:

Species	Forage Rate	Cover Crop Rate
• 718 Winter triticale	75	6
• Flex forage peas	15	0
• 4010 forage peas	15	8
• Austrian winter peas	15	8
• Windham winter pea	15	8
• Hairy vetch	7	4
• Red clover (Starfire)	3	3
• Purple top turnip	1	1
• Daikon radish (Soilbuster)	2	2
Total lbs/acre and seed cost	148=$86/acre	40=$43/acre

The seed mix selected for the demonstration in 2014 included:

Species	Forage Rate	Cover Crop Rate
• 718 Winter triticale	15	10
• Flex forage peas	19	13
• Austrian winter peas	19	13
• Purple top turnip	3	2
• Daikon radish (Soilbuster)	3	2
Total lbs/acre and seed cost	60=$42/acre	40=$28/acre

The seed mixes shown above were selected to provide a good cross section of annual and perennial legume, cool season grass, and brassicas. The planting rates were chosen expecting that yields for grazing would be higher if the mix was planted at a higher rate and planting for soil cover would not require as much seed.

OBSERVATIONS

Seed Selection and Planting

Before the first seed was planted several things became evident. When putting together seed mixes of nontraditional species it is critical to place the seed order well in advance of when the seed is needed, in this case two-three months was not too early. As cover crops become more common place seed availability may become difficult and producers should identify supplies in advance. Cover crop species are like any other seed and cost money. As shown in the tables above seed mixes can get expensive rather quickly and it is recommend to make species selections for specific reasons to be sure the plants do what is expected. It should be noted that from 2013 to 2014 the seed mix changed. The overarching objective of the project was to

develop recommendations that producers would actually use. Producers told the team many times that around $40/acre for seed costs is what they would be willing to pay for cover crop mixes. Mixes to be used for forage could cost more because of their feed value back to the producer. The mix planted in 2014 did not include the perennial legumes, clover and vetch. In the spring of 2014, it was observed at each demonstration site neither of these species had enough time to grow and develop before the cover crops were tilled out for the next crop. Perennial legumes need several months of growing season to develop the roots and plant mass to contribute appreciable nitrogen back to the soil. The red clover cost $3.20/lb. and was by far the most expensive seed in the mix and hairy vetch cost $1.45/lb. The two combined contributed $15.40 to the cover crop mix and $19.75 to the forage mix. Clover and vetch contributed significant per acre costs to the seed mix without contributing anything useful to the resultant crop. If the cover crops had been allowed to grow an entire summer the results no doubt would be different.

When planting cover crop mixes it is recommended to put large seed in the large seed box and small seed in the small seed box if the drill is so equipped. Our observations were that producers dumped it all in the largest box on the drill, mixed it up a little and began planting. Attempting to calibrate a drill with seed as large as peas and small as turnips can become a long enduring process. The planter operator must plan properly so there is enough seed to finish the planned acreage. Finding more of the same seed if a field comes up short will prove difficult if not impossible. It is recommended to stop the planter occasionally and remix the seed in the box as it may tend to sort by size as the drill shakes though the field. When planting several legumes in the mix it will be necessary to ensure the proper inoculant is used and the seed supplier should be able to make recommendations.

After planting irrigation is essential. Under normal conditions, August is a very dry month in southern Idaho and cover crops will fail without irrigation. One or two irrigations may be enough. When considering the costs of putting in a cover crop, irrigation and associated labor must be included. Sites where only one irrigation was used the cover crops germinated and emerged but growth and yield were not as high as those sites with adequate irrigation throughout the remainder of the growing season. If the management goal is only to provide cover on the soil to reduce erosion and hold winter moisture, one irrigation is sufficient. Plant growth and yield is directly correlated to water availability so supplying sufficient water to the cover crop will improve forage quantity.

Growth and Yield

The two most important keys to success observed in this demonstration were an early planting date, as close to August 1 as possible and sufficient irrigation for good quick germination. In August soil and air temperature are high enough to aid in quick emergence of the cover crop if moisture is present. The early planting date is critical as even in August the night temperatures are cool and daylight hours are waning adding to reduced growing degree days available to produce a good cover crop. Stand establishment was sufficient with the three major planting methods used: no till drilling, tilling and drilling with a conventional drill, and tilling and blowing seed on with some fertilizer followed by a pass with a roller harrow. Sprinklers gave the most rapid and complete coverage of irrigation. Furrow irrigation was successful but getting

good wetting between rows can require several extra hours per set if the soil is dry and loose from tilling. The process is no different than germinating a cereal grain crop.

The researchers observed that various species in the mix performed differently at on-farm sites based on the type of irrigation and tillage practices. The furrow irrigated sites seemed to favor triticale and volunteer grain. The sprinkler irrigated sites seemed to favor the radish and turnips. One observation was clear: if the cereals emerge and grow ahead of the brassicas, they make for tough competitors. Volunteer barley can be especially troublesome if the soil is moist enough to allow germination before the cover crop is planted. Tillage will kill the volunteer but no-tilling into volunteer barley can pose a challenge for the cover crop to compete. Based on the limited examples we observed, if barley has grown even to 4-6" before planting then some method, either tilling or spraying, to kill it will give the cover crop a much better chance for success. Producers should bear in mind that late summer/early fall days are shorter and cooler, thus seeded plants will benefit from the assistance of not having to compete with volunteer plants. On one farm volunteer barley became well established due to the heavy August rain of 2014. The producers objective was feed for his cattle so we recommend no-till drilling into the barley and including the volunteer barley as part of the mix. By the time the soil dried enough to plant, the barley was 8-10" tall. When the producer turned cows into the field in the middle of October the barley had headed out and the cows did not want to graze down below the awns to get at the cover crop below. The proper recommendation would have been to kill the barley first. The resultant cover crop did not grow well due to competition from the volunteer cereal.

The sites grown for cover crop only were not clipped for yield. The observational data collected included establishment method, species productivity, and spring regrowth. Yield samples were collected from the sites grown for forage with results shown below. The yield is shown as 100% dry matter (DM) per acre. The sites were planted at a theoretical 148 lbs/acre in 2013 and 60 lbs/acre in 2014.

2013

Irish Farm	furrow irrigation	7000 lbs DM/acre
Huettig Farm	Pivot irrigation	4600 lbs DM/acre (single irrigation applied)
Johnson Farm	Wheel line Irrigation	3500 lbs DM/acre

2014

Cornie Farm	Pivot irrigation ½ of pivot	3600 lbs DM/acre (planted at 60 lbs/a)
Cornie Farm	Pivot irrigation ½ of pivot	2800 lbs DM/acre (planted at 40 lbs/a)
Porath Farm	furrow irrigation	7000 lbs DM/acre (mostly volunteer barley)
Meeks Farm	Pivot irrigation	6700 lbs DM/acre

Taking the average production of both years, 2013 was 5,033 lbs DM/acre while 2014 was 5,766 lbs DM/acre not including the one 40 lbs/acre planting rate. There are not enough data points to make any statistical conclusions, however, it does not appear that planting 148 lbs/acre gained any advantage over planting 60 lbs/acre but that seed mix and planting rate were significantly more expensive. One theory is that at 148 lbs/acre the cover crop was competing against itself and did not do as well overall. Soils throughout the region were wet deep into the profile after heavy rains in August 2014 and that very likely made some difference as well as significant

volunteer cereal growth. As with any type of yield trial, one year's worth of data does not lead to solid conclusions.

LESSONS LEARNED

Growing cover crops was a new experience for the Extension team working on this demonstration project and for many of the producer cooperators as well. New information was learned and it became obvious that we have only scratched the surface on what we need to know. There is much additional opportunity for research and demonstration. Cover crops will become more a part of farm crop rotations in the future as conservation plans will require more constant ground cover. The following is a list of immediate lessons learned:

- Seed mix expense can build rapidly, choose carefully.
- Perennial legumes are too expensive to include in fall planted mixes that will be taken out in the spring.
- Must have irrigation for establishment.
- Proper planting practices are important.
- Drill calibration is important.
- Planting timing is critical.
- Cover crops must be treated with the care and managed like any crop.
- Start small, learn, then plant increase acreage.
- Cover crops are not a fix-all magic bullet.
- Some species are nitrate accumulators, test before turning in the stock.

Equally as important as the lessons learned was identifying those areas where more research and knowledge is necessary. Some of the critical questions that must be answered are:

- How much organic matter is really added to the soil?
- How long will the organic matter remain in the soil?
- How much nitrogen is added to the soil?
- When will the nitrogen be available? (especially important to sugar beet and malt barley growers)
- If cover crops and no-till practices are used with sugar beets or potatoes in the rotation, will tilling and digging the vegetable crop undo the soil improvements gained in previous years?
- How do cover crops affect the next crop?
- How do producers manage green bridge issue in cereal crops?
- Are there grazing restrictions on chemicals used on the cash crop that can be carried over to the cover crop?

SUMMARY

The multi-species cover crop demonstration study showed that cover crops can be grown across the Magic Valley region of southern Idaho under a wide variety of management practices. Planting cover crops after cereal crops are harvested give the highest opportunity for success. Further study needs to be conducted to determine if or what species can be planted behind dry

beans or early sugar beets and potatoes. Sugar beets and potatoes that come out late leave no time for a crop to germinate and grow enough to provide cover crop type protection.

Cover crops can provide many tons of usable forage per acre. The forage can be grazed or green chopped and stored. Cover crop forage yield from farm to farm or year to year will be much more erratic than a crop such as alfalfa but they can be used to extend the grazing season, add some spring grazing with winter hardy species, or provide a farm with additional income through rent.