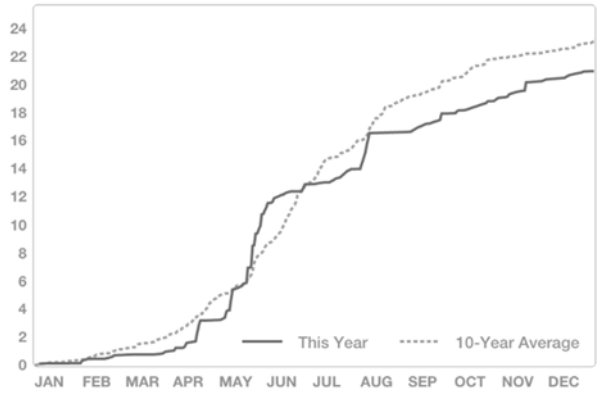
Nebraska On-Farm Research Network

Sustainability of Replacing Summer Fallow with Grain-type Field Peas in Semiarid Copping Systems

Study ID: 174029201501
County: Chase
Soil Type: Blackwood loam;
Field peas Planting Date: 3/27/2015
Field peas Harvest Date: 7/20/2015
Wheat planting date: 9/14
Population: 180 lb/ac
Row Spacing (in.): 10
Cultivar: Salamanca
Reps: 9
Previous Crop: Corn
Tillage: No-Till
Farm inputs: In table below

Rainfall (in.):



Introduction:

Using cover crops to improve soil quality in semiarid environments of western Nebraska where water is the major yield limiting factor may not be economically justified. In adition, sustaining no-till summer fallow has been an ongoing struggle for farmers in western Nebraska due to evolution of herbicide-resistant weeds and the absence of new herbicide Modes of Action (MOA) in the past 25 years. Growing grain-type field peas (cool-season legume) instead of no-till summer fallow may provide solutions to this problem as it can: (1) reduce the number of herbicide applications, delay the evolution of herbicide-resistant weeds and preserve no-till summer fallow; (2) provide rotational benefits through N fixation, improve soil physical properties and increase biodiversity above and below ground; and (3) generate profit. Trade-offs are associated with the possibility of field peas leaving dry soil behind them, which depending on precipitation and soil moisture status may hurt the yield of the succeeding wheat crop (yield penalty may equal 5-6 bu/ac/inch).

Objective:

The objective of this 2-year rotational study was to compare the impact of field peas vs fallow on water use, soil fertility, beneficial insects, yield of succeeding wheat crop, and profitability.

Research Method:

Study was set as pairwise comparison of field peas vs fallow with 9 replications. Actual evapotranspiration (ET, i.e. **water use**) was estimated using soil water balance method: ET = Rain + Soil water at beginning – Soil water at end – Runoff – Deep percolation. **Soil fertility** was evaluated for both treatments by testing soil samples for NO3-N, P, K, organic matter, and microbial activity throughout the season. **Beneficial insects** were collected using pitfall traps and nets (nets only in field peas) 2 times during the growing period. **Profitability** was calculated for both treatments based on: current price of field peas on the market ($5.5/bu), actual costs of farm inputs (seed, fertilizer, herbicides, etc.), and farm operations (planting, spraying, harvest) based on UNL crop budgets in 2016. Effects of treatments on wheat yield is yet to be evaluated. Only soil fertility, water use and profitability data will be reported here.

Results:

Field peas were well established and displayed good emergence and nodulation (Figure 1).

Soil samples from field peas and fallow showed no difference in actual nutrient concentration (Table 1). However, a Solvita test taken just prior to planting wheat indicated higher soil-microbial activity and greater annual N release in parts of the field where field peas were grown (Table 1).

Table 1. Seasonal changes in NO3-N, P, K, and OM in field peas and fallow

date	depth (in)	Treatment	NO3-N	P1	K	OM
	inches		lb/ac	ppm	ppm	%
Mar 27, 2015	0-8	Field peas	20	23	389	1.7
		Fallow	19	26	365	1.7
Sep 14, 2015	0-8	Field peas	33	102	966	1.9
		Fallow	34	82	1066	2.1
Oct 16, 2015	0-12	Field peas	60	24	424	1.8
		Fallow	40	14	361	1.6
	13-24	Field peas	43	13	442	1.4
		Fallow	95	90	431	1.7
	25-36	Field peas	35	9	340	1.4
		Fallow	47	9	519	1.3

date	depth (in)	Treatment	CO2-C	N release/year
	inches		ppm	lb/ac
Oct 16, 2015	0-12	Field peas	52	42
		Fallow	28	22

Water use data indicated that field peas used 10.9 inches of water to produce 36 bu/ac yield (water productivity = 3.3 bu/ac), leaving 6.9 inches of soil moisture at the time of harvest (2.9 inches < fallow). Following harvest, (until 11-15-2015) there was enough time to allow the soil moisture profile to refill with 5.3 inches (1.7 + 3.6) of rain and ensure good winter wheat crop establishment (Table 2). Conversely, the fallow treatment lost 6.0 inches through deep percolation and evaporation while field peas were growing, produced no yield, and did not have capacity to store 5.6 inches of rainfall (Table 2).

Table 2. Temporal changes in soil moisture status (in inches) in top 3 foot of soil, rain, ET, field peas water productivity of field peas and fallow during 2015 growing season

Period	Treatment	beginning soil moisture	Rain	ending soil moisture	ET	Yield (bu/ac)
3-27 to 7-20	Field peas	10.0	12.1	6.9	10.9	36
	Fallow	10.0		9.8	6.0	
7-20 to 9-14	Field peas	7.0	1.7	7.8	**Water Productivity (Yield/ET) = 3.3 bu/inch**	
	Fallow	10.0		10.0		
9-14 to 11-15	Field peas	7.8	3.6	adequate		
	Fallow	10.0		adequate		

-3-27-2015 field peas planted, 7-20-2015 field peas harvested, 9-14-2015 wheat planted

A **profitability** analysis showed that raising 36 bu/ac field peas and selling them at $5.50/bu market price generated a profit of $54/ac, while the fallow treatment cost $57. This resulted in a $111/ac difference in the farmers' potential income. Further economic analysis will be performed after wheat harvest and will take into account potential benefits from increased microbial activity and a higher N release rate that was observed where field peas were grown.

Table 3. Profitability per acre of field peas vs fallow

Field peas			Fallow		
Date	**Input**	**Cost ($/ac)**	**Date**	**Input**	**Cost ($/ac)**
3-27-2015	Planting	11.2	6-3-2015	Spraying	4.2
	Spraying	4.2		Burndown herbicide	14.9
	Seed	45.0	7-15-2015	Spraying	4.2
	Inoculant	12.0		Burndown herbicide	14.9
	PRE herbicide	28.2	8-21-2015	Spraying	4.2
7-20-2015	Harvest	24.1		Burndown herbicide	14.9
9-3-2015	spraying	4.2		SUM	57
	herbicide	14.9		**PROFIT**	**-57**
	SUM	144			
	PROFIT	**+54**			

Conclusion:

Field peas have the potential to be used as an alternative to no-till summer fallow in wheat-fallow and wheat-corn-fallow rotations to increase sustainability. Results from this year showed that field peas had better water utilization, higher soil microbial activity, and were more profitable than fallow. It is also important to mention that this year's weather conditions (i.e. wet year) favored field peas over fallow. Consequently, this research needs to be replicated in dry years to capture worst case scenarios. Nevertheless, no-till summer fallow will remain an important water conservation practice in western Nebraska.

In Partnership with: