Sustaining Winter Wheat Production using Biochar Amendments in Northeast Oregon (SOW)

Tasks/Objectives

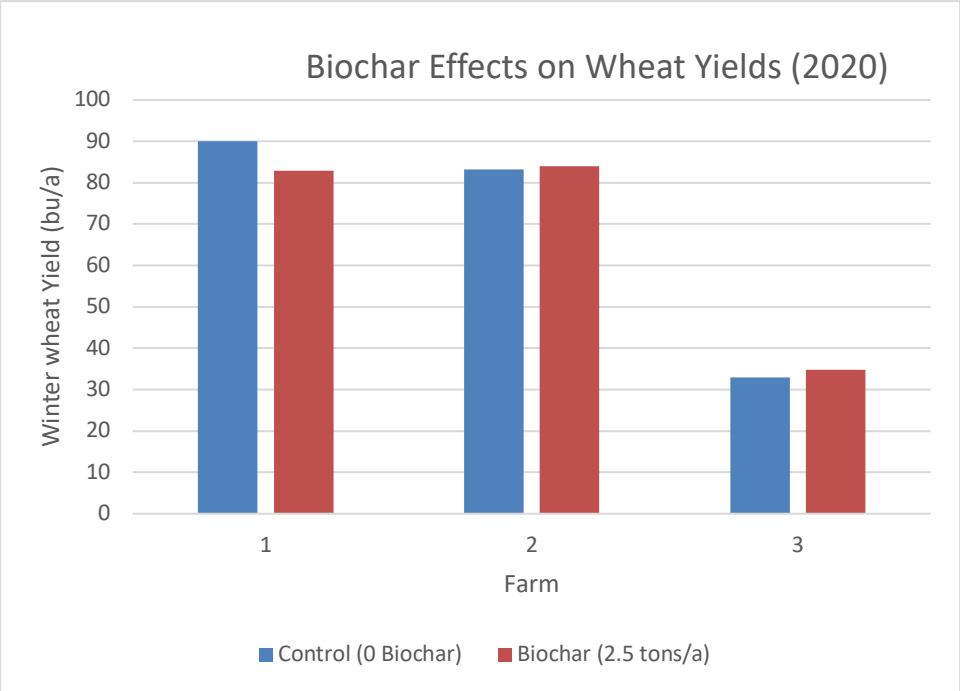
We propose to improve soil health and enhance sustainability of WW-SF systems using biochar, charcoal produced from pyrolysis (biomass combustion at low oxygen levels)
The main objectives are:
1) To evaluate the impacts of biochar amendments on SOC, pH, active C, mineralizable C and N, bulk density water holding capacity (WHC), electrical conductivity (EC), cation exchange capacity (CEC), base saturation, N, P, K, Ca, Mg, S, Na, Al, Fe, Mn, and Zn. Available literature indicates that biochar has potential to improve soil physical, chemical, or biological properties and thereby provide promising agronomic effects [14-18].
2) To investigate if soil improvements (Objective 1) due to biochar amendments increase wheat emergence, biomass accumulation, wheat N use efficiency, water use efficiency, and grain yield.
3) To determine if biochar impacts persist beyond the first year. Biochar carbon is resistant to decomposition and is known to last for hundreds of years. We are interested in knowing whether this is also true for associated changes in soil properties and grain yield.
4) To communicate the research and disseminate findings through an effective education and outreach plan.

Materials and Methods

Rogue Biochar, produced by Rogue Biochar Solutions was applied (0 vs 2.5 tons/a) on 4 farms, two in a 16-18 inch precipitation zone and 2 in a 10-12 inch precipitation zone during the 2019-20 crop-year. The other cooperator still has hay in the field he chose for the experiment and biochar will be applied to his field after removal of hay. The biochar was produced from Douglas Fir and analysis of the biochar show that it had a pH of 9.48, carbon content of 83.9%, and a liming value of 10 (see attached analyses report). No more biochar will be applied on the farms but wheat yield and soil properties data will continue to be monitored for two or more years to determine biochar effects and how long those effects persist. We obtained yield data but soil analysis results obtained after wheat harvest, to determine how biochar had changed soil chemical properties, have not yet been obtained. In this preliminary report, we will report results of wheat yields only.

Results (2019-20 crop-year)

Wheat yields from the 2019-20 year are shown in Figure 1. Farm 1 and 2 are located in the 16-18 inch precipitation zone and farm 3 is located in the 10-12 inch precipitation zone. The results show that winter wheat yield was higher in farms in the higher precipitation zones than in the farm in the lower precipitation zone. However, there were no significant difference between control (0 biochar) and biochar (2.5 ton/a) treatments at all farms suggesting that maybe the 2.5 tons/a of biochar was not sufficient to influence grain yields. In previous work, we obtained significant yield increases when biochar was applied at 5 and 10 tons/a. In this study, we decided to apply the lower rate to reduce biochar costs but based on these preliminary results, 2.5 tons/a may not be enough to increase wheat yields. We may increase the rate to 5 tons/a depending on the availability of biochar.



Proposed Timeline

Objectives	Project activities	2019/20 Crop Year												2020/21 Crop Year												2021/22 Crop Year							
		Apr to Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Objectives 1-3 (Research)	Biochar and supply procurement	■	■										■	■																			
	Experimental layout		■												■																			
	Soil sampling and analyses		■	■	■	■									■	■	■	■	■								■	■	■	■				
	Biochar application			■												■																		
	N-application and wheat planting				■												■												■					
	Wheat emergence & pop count				■												■												■					
	Bundle harvest & plant analyses												■	■	■	■										■	■	■						
	Combine harvest & yield determination												■	■	■	■										■	■	■						
Objective 4 (Outreach)	Newsletters, extension articles, & website publications									■	■	■										■	■	■									■
	Radio advertisement & interview										■	■											■	■										
	Farm tours											■	■											■	■									
	CBARC Field Day												■												■									
	Webinar publication																													■			
	PNDSA Growers' Conference																														■		
	Journal article publication																											■	■	■	■	■	■
	Annual reports (WSARE)										■												■											■