

WISCONSIN–Kernza Forage Value & Profitability Increases with Intercropping Legumes

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Kernza intermediate wheatgrass (IWG) is a new perennial grain and forage crop which provides environmental benefits such as soil conservation and carbon sequestration. Kernza grain yield averages 410 lbs/ac in farmer fields and has reached 1,430 lbs/ac in experimental fields. Breeders expect IWG to yield similar to wheat in the coming decades (Franco et al., 2021). In summer, after grain harvest, the forage can be harvested and mixed with higher value forage to feed beef or dry dairy cows. Spring and fall forage can be grazed or harvested to feed lactating beef cows, dairy cows, and growing heifers (Favre et al., 2019). Intercropping IWG with legumes may increase forage yields and nutritive value but could compromise Kernza grain yields. The interaction between IWG and legumes depends on planting season, row spacing, and legume species. IWG requires vernalization for flowering, thus, spring seedings will not produce grain during the 1st year. IWG cropping system profitability depends

on both grain and forage incomes but has not been evaluated for intercropping systems. Our aim was to evaluate effects of intercropping legumes on Kernza grain yield, summer and fall forage yield and nutritive value, and profitability in WI.

At Arlington, we compared IWG monocultures and 4 IWG–legume intercrops (IWG with alfalfa, Berseem clover, Kura clover, or red clover) when IWG was planted in both fall and spring. Most intercropping systems were similar to IWG monoculture in grain (ranging 581–1,035 lbs/ac) and forage yield (ranging 2,444–4,630 lbs/ac) and improved forage quality. However, for spring-planted IWG, intercropped with red clover or alfalfa, grain and forage yields were lower. The best performing intercrops in the 1st year were Kura clover in spring planting and red clover in fall planting. In the 2nd year, grain yield decreased 84% on average across all systems.

Profitability was calculated from current market rates and the estimated production cost in WI. Kernza grain prices before cleaning were \$1.50/lb. Forage price was assigned using RFV by quality grade (Halopka, 2022). A conservation payment from the Conservation Security Program (CSP) was included (NRCS, 2022). When Kernza was planted in spring, we estimated the land opportunity cost from a 3-year-old alfalfa stand. Overall, IWG–legume intercropping profitability ranged \$642–\$2,373/ac, encouraging the adoption of dual-purpose perennial crops.

Table 1. Grain and forage yields, costs, income, and annual profit of 4 IWG cropping systems in WI.

Cropping system	IWG monoculture		IWG + Kura clover		IWG + Red clover		IWG + Alfalfa	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Production (lbs/ac/year, averaged for 2 years)								
Kernza grain yield	598 a	487 a	327 a	442 ab	55 c	425 a	101 bc	376 ab
IWG summer forage yield	2,644 a	2,924 a	2,483 a	3,532 a	726 c	2,175 ab	1,208 bc	2,335 ab
Legume summer yield			1,839	1,142	1,882	2,820	1,045	659
IWG fall forage yield	942 a	537 ab	581 ab	592 ab	200 b	599 ab	472 ab	677 b
Legume fall yield			1,305 a	375 b	1,414 a	860 ab	879 ab	414 b
Summer forage RFV	87 b	87 b	107 ab	96 ab	127 a	105 ab	108 a	97 ab
Fall forage RFV	107 b	107 b	141 a	123 ab	148 a	134 a	131 a	123 ab
Economics (\$/ac/year, averaged for 2 years)								
Costs	\$1,509	\$1,403	\$1,761	\$1,781	\$1,526	\$1,539	\$1,519	\$1,554
Alfalfa forage	0	262	0	262	0	262	0	262
NRCS payment	321	321	321	321	321	321	321	321
Kernza grain	2,154	1,756	1,181	1,596	203	1,534	363	1,354
Summer forage	753	541	1,460	966	1,114	1,302	810	598
Fall forage	348	114	981	262	850	469	640	289
Total income	\$3,577	\$2,994	\$3,942	\$3,406	\$2,487	\$3,888	\$2,134	\$2,823
Annual profit	\$2,067 ab	\$1,590 ab	\$2,181 a	\$1,625 ab	\$ 960 ab	\$2,348 a	\$ 615 b	\$1,269 ab

Same letters indicate there are no differences at alpha=0.05.