Table 1: Contrasts of rotation effect (expressed by Crop ID) on crop yields. The abbreviations on the contrast column are crop identities, which are the combinations of the first letter in crop species names and the rotation in which it occurred.

ANOVA					Comparison		
Source of variation	df1	df2	F	p	contrast	ratio	p
(A) - Corn							
Crop ID	2	6	3.19	0.1138	C2 vs C3	0.94	0.1882
Corn weed management	1	3	0.32	0.6088	C2 vs C4	0.93	0.1278
Crop ID x Corn weed management	2	6	2.20	0.1914	C3 vs C4	0.99	0.9507
(B) - Soybean							
Crop ID	2	6	8.22	0.0191	S2 vs S3	0.96	0.5499
Corn weed management	1	3	0.18	0.7018	S2 vs S4	0.86	0.0181
Crop ID x Corn weed management	2	6	0.62	0.5678	S3 vs S4	0.90	0.0670
(C) - Oat							
Crop ID	1	2	1.35	0.3647	O3 vs O4	0.91	0.3647

Note: Corn weed management: low herbicide or conventional. Crop ID: crop species and the cropping system in which it occurred: C2 - corn in the 2-year rotation, C3 - corn in the 3-year rotation, C4 - corn in the 4-year rotation, S2 - soybean in the 2-year rotation, S3 - soybean in the 3-year rotation, S4 - soybean in the 4-year rotation, O3 - oat in the 3-year rotation, and O4 - oat in the 4-year rotation.

How did rotation system and corn weed management affect crop yields? Results of the experiment indicated that crop diversification and reduced use of herbicides were not associated with lower crop yields (Table 1). Averaged over four years, soybean was the only crop whose yield was affected by rotation ($p = 0.0191$, Table 1). Soybean yield was 16% higher in the 4-year rotation than in the 2-year rotation ($p = 0.0181$). Crop yields in the experiment were as high or higher than the averages for the state of Iowa and Boone County (Figure 1).

Why is Marsden hay yield in ton/ac lower than IA and Boone averages, while yield in Mg/ha higher?

```
crops.emmip.IA %>%
  filter(Commodity == "alfalfa hay") %>%
ggplot(aes(x = Crop_ID, y = yvar, fill = Rotation))+
  geom_bar(stat = "identity") +
  scale_fill_brewer(palette = "Dark2") +
  geom_errorbar(aes(ymin= LCL, ymax= UCL), width=.2) +
  facet_grid(.~ Commodity, scales = "free", space = "free") + # scales: remove empty bar, space: equal
  geom_hline(aes(yintercept = IA_avg_Bu, linetype = "IA average")) +
  geom_hline(aes(yintercept = Boone_avg_Bu, linetype = "Boone County average")) +
  ylab("Crop yield (ton/ac)") +
  xlab("Crop identity") +
  labs(linetype = "Yield") +
  theme(legend.position="bottom")
```

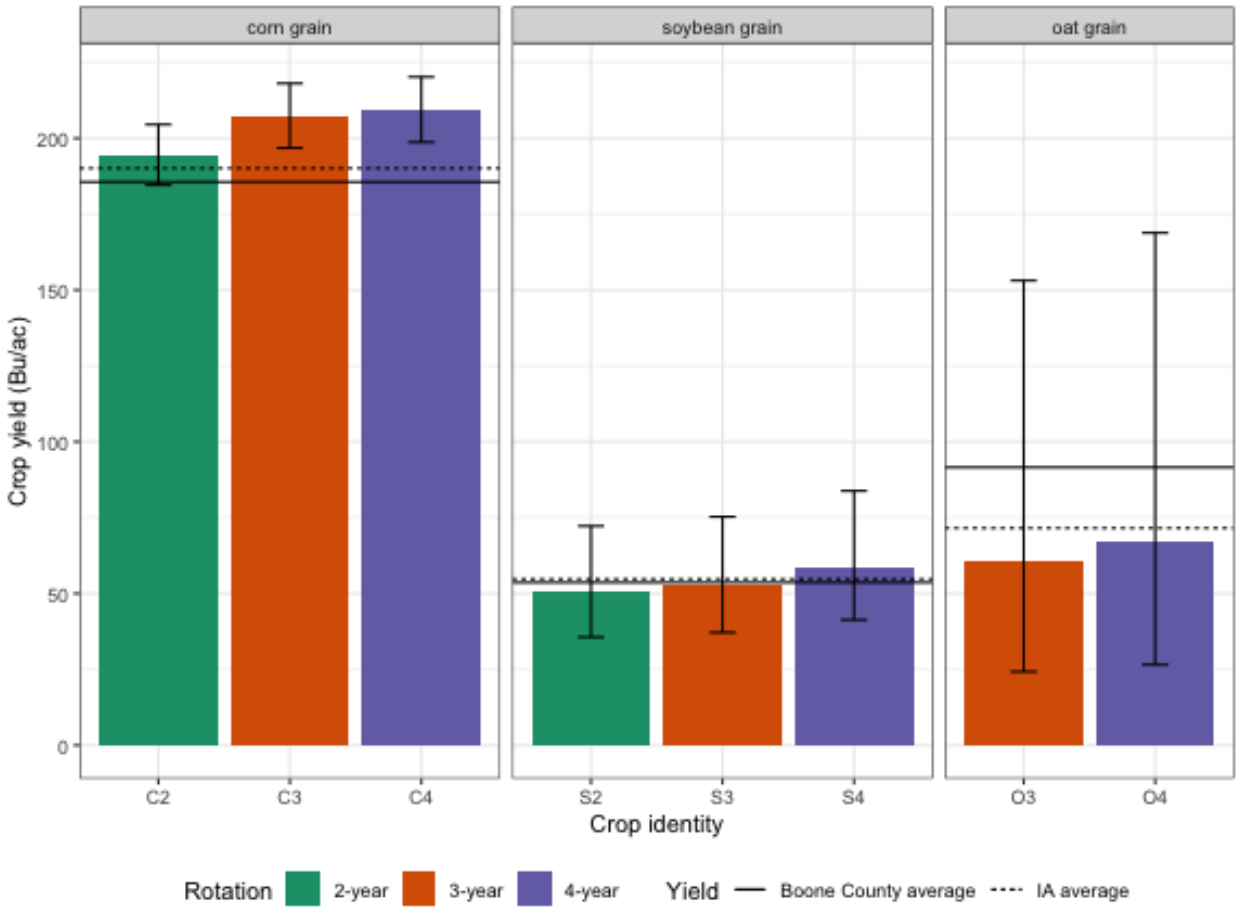
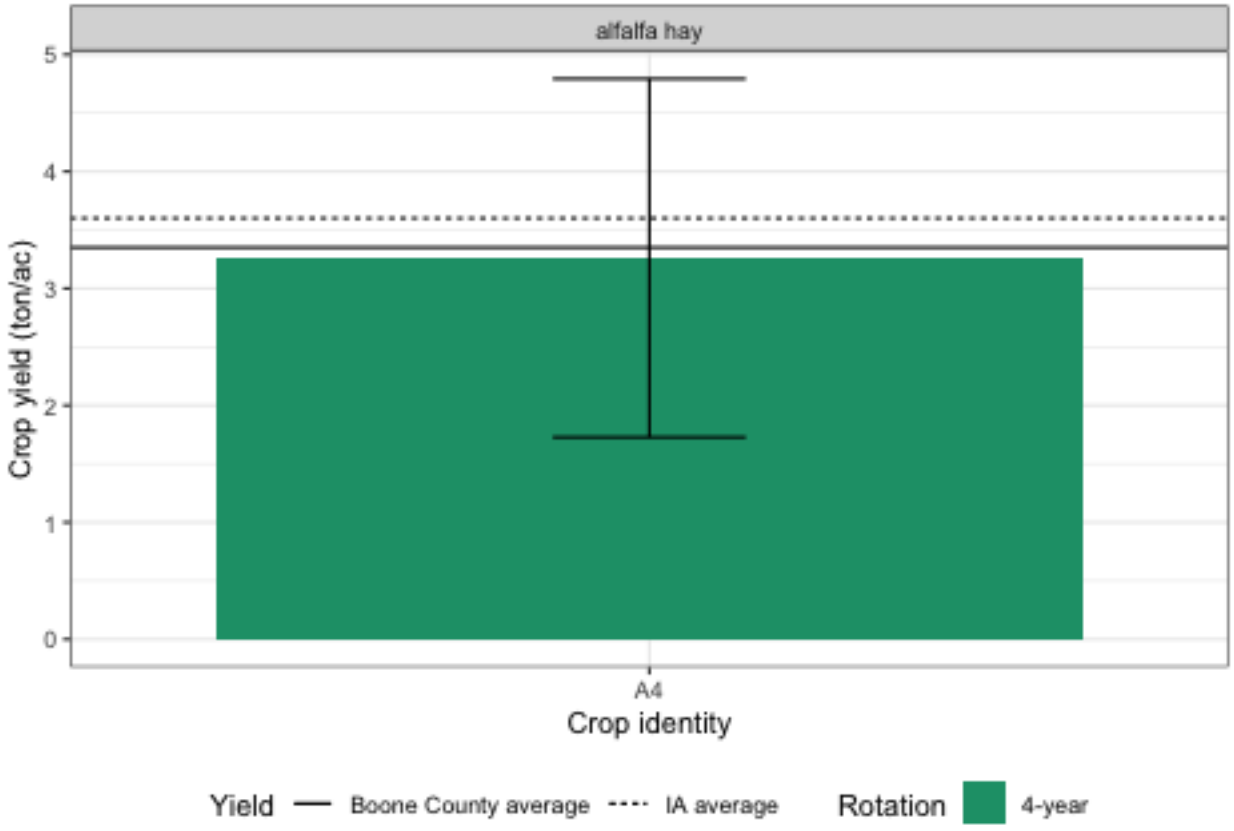


Figure 1: Mean crop yields by rotation from 2017 to 2020. The color-coded bars show crop yields (Mg ha^{-}1) in the experiment plots. The error bars show the 95% confidence intervals. The solid horizontal lines show mean yields for Iowa and dashed lines show mean yields for Boone County. Corn, soybean, and alfalfa yields in the experiment were averaged over four years, oat grain yields in the experiment were averaged over 2017, 2019, and 2020 because in 2018 oat was harvested for hay. Boone County and Iowa hay yields were averaged over 2017 and 2018 because 2019 and 2020 yields were not available at this writing.


alfalfa hay
5
4
3
2
1
0
Crop yield (ton/ac)
A4
Crop identity
Yield
Boone County average
IA average
Rotation
4-year