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## LAND & LIVESTOCK

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### Hay Yields of Perennial Cool Season Grasses under Irrigation from Monoculture and Mixed Stands

A study conducted at the Gerry Miller ranch NW of Buffalo between 2009 and 2012 was designed to assess hay yields of mixed stands of grasses and compare their yields with those of the same grasses in monoculture stands. In addition, it was also desired to see if the mixtures maintained their integrity; that is, if the composition of the mixes changed or not.

#### Methods

In April 2008 'Paiute' orchardgrass (OG), 'Paddock' meadow bromegrass (MBG), 'Manchar' smooth bromegrass (SBG), 'Luna' pubescent wheatgrass (PWG), 'Oahe' intermediate wheatgrass (IWG), 'NewHy' hybrid wheatgrass (HWG), 'Hycrest' crested wheatgrass (CWG), and 'Bozoisky' Russian wildrye (RWR) were each seeded into three replicated plots in an cultivated field at Miller's. In addition, the following eight

mixtures of these grasses were also seeded into like plots (# = % of mix):

OG (39) + MBG (61);  
OG (30) + MBG (47) + PWG (23);  
OG (23) + MBG (57) + SBG (20);  
OG (18) + MBG (45) + PWG (21) + SBG (16);  
RWR (53) + IWG (47);  
RWR (41) + IWG (27) + HWG (32);  
RWR (35) + IWG (31) + CWG (34); and  
RWR (26) + IWG (24) + HWG (24) + CWG (26)

The OG, MBG, PWG, and SBG mixes are considered to be less drought tolerant than the RWR, IWG, HWG, and CWG mixes, although PWG and IWG are very similar in their response to dry conditions. The reason for this delineation in mixes is that the field the grasses were seeded into is a low irrigation priority field; that is, if irrigation water is short this field will not be watered. The field is irrigated with gated pipe.

The desired seed amounts of each grass in a mixture was 50:50 for the two grass mixes; 33:33:33 for the three grass mixes; and 25:25:25:25 for the four grass mixes. The reason that 'Paddock' MBG was seeded at a higher rate than these amounts was due to miss information on the number of seeds per pound it has. It has 93,000 seeds per pound but seeding amounts were calculated for 40,000 seeds per pound. Had the correct amount been used the seeded amounts would have been very close to the desired percentages. The reason that 'Bozoisky' RWR and 'Oahe' IWG seed amounts in the mix with 'NewHy' HWG were higher and lower than desired was due to not enough 'Oahe' seed being included in the mix.

## Results and Discussion

### Hay Yields

'Oahe' IWG produced the most hay over the four years (2009 – 2012) among the grass monocultures and mixtures with a yearly average of 2.4 tons per acre (T/ac) (Table 1). 'Luna' PWG, 'Hycrest' CWG, 'Paddock' MBG, and the mixture of 'Bozoisky' RWR, 'Oahe' IWG, 'NewHy' HWG and 'Hycrest' CWG produced the next most at an average of 2.0 to 2.1 T/ac. 'Paiute' OG yielded the least amount of hay at an average of 1.3 T/ac with 'Bozoisky' RWR, and the 'Paiute' OG and 'Paddock' MBG mix the next lowest amounts at 1.6 T/ac.

Generally the mixtures with 'Bozoisky' RWR and 'Oahe' IWG had slightly higher hay yields compared to the mixtures with 'Paiute' OG and 'Paddock' MBG by an average of 0.23 T/ac (Table 1). 'Oahe' and 'Bozoisky' from the monoculture stands yielded an average of 0.31 T/ac more hay compared to 'Paiute' and 'Paddock', whereas the average hay yields of 'NewHy' HWG and 'Hycrest' CWG were similar to that of 'Luna' PWG and 'Manchar' SBG.

As the number of grasses in a mix increased the hay yields generally increased (Fig. 1). It is likely that the reason for the lower yields with fewer grasses was due to 'Paiute' OG and 'Bozoisky' RWR being part of the mixes. As noted above these two grasses produced the least amount of hay among the monoculture stands, so as number of grasses in a mix increased; the less seed of these two were in the mix reducing their influence on the amount of hay produced by the mix. Thus, it is possible that 2- and 3-grass mixtures not including 'Paiute' or 'Bozoisky' would have had greater hay yields.

'Paiute' OG and 'Bozoisky' RWR are highly palatable with 'Bozoisky' having the highest drought tolerance among the grasses in this study. It is also the first to begin growth in the spring. Although 'Paiute' is probably the least drought tolerant among these grasses it is the most drought tolerant variety of orchardgrass. 'Paiute' was also the last of these grasses to begin growth in the spring which might explain in part its lower yields compared to the others but it does exhibit better regrowth following defoliation comparable to that for the meadow bromes. Thus, although grass mixtures may not be advantageous for hay production as compared to monocultures of these grasses, mixes of them could be a benefit for irrigated pasture.

### Grasses: % of seed mix and % of hay yields

The amount of 'Paiute' OG, 'Paddock' MBG, 'Luna' PWG, and 'Manchar' SBG seed in the mixtures they were part of averaged 28%, 53%, 22%, and 18%, respectively, and the amount they each contributed to the total hay yields of the mixes averaged 26%, 54%, 20%, and 21%, respectively (Fig. 2). Based on the above; even a 50:50 mix of 'Paddock' and 'Luna', the two grasses that produced the most hay in monoculture stands among these four, would probably not yield any more hay than these two did .

Although the amount of ‘Bozoisky’ RWR, ‘NewHy’ HWG, and ‘Hycrest’ CWG seed in the mixes averaged 39%, 28%, and 30%, respectively, they only contributed an average of 27%, 17%, and 21% to total hay yields (Fig. 3). Whereas the amount of ‘Oahe’ IWG seed in the mixes averaged 32% it supplied an average of 55% to total hay yields. Thus, it would appear that no mixture with or without ‘Oahe’ would yield more hay than the amount obtained from ‘Oahe’ alone.

Although hay yields varied from year to year due to the amount of nitrogen fertilizer applied and when and how much precipitation occurred the average annual change in yields among the grasses within the mixtures was positive for ‘Paiute’ OG and ‘Paddock’ MBG of the low drought mixes and for ‘Bozoisky’ RWR and ‘Oahe’ IWG of the high drought mixes (Table 2).

‘Paiute’ OG is a bunchgrass whereas the other three grasses in the low drought mixes are rhizomatous so its increase in the amount of hay it yielded within the mixes was

surprising. Of the other three grasses ‘Manchar’ SBG is considered to be the most aggressive so its apparent decline was unexpected.

‘Bozoisky’ RWR and ‘Hycrest’ CWG like ‘Paiute’ OG are bunchgrasses so the apparent increase in hay yield of ‘Bozoisky’ within the mixes is also a surprise but the decline in ‘Hycrest’ is what would be expected when other grasses in the mix are rhizomatous (‘Oahe’ IWG and ‘NewHy’ HWG).

### Summary

Grass mixes generally did not yield as much hay as the monoculture stands. However, as number of grasses in a mix increased hay yields increased. Although there was some change in the amount each grass contributed to hay yields of a mixture between 2009 and 2012 it is too early to determine whether any of the grasses are actually displacing any of the other grasses within a mix.

Table 1: Hay yields in T/ac on 22 June 2009, 22 June 2010, 2 July 2011, and 22 June 2012 for the monoculture and mixed grass stands.

Grass	Monoculture Yields				Grass Mix # <sup>1</sup>	Mixture Yields			
	2009	2010	2011	2012		2009	2010	2011	2012
‘Paiute’ OG	0.87	1.76	1.03	1.55	3	0.97	2.28	1.18	1.75
‘Paddock’ MBG	1.61	2.94	1.55	1.96	5	1.52	2.30	0.95	1.78
‘Lunar’ IWG	1.86	2.77	1.61	2.02	7	1.31	2.31	1.22	1.70
‘Manchar’ SBG	2.09	2.59	0.92	1.53	8	1.61	2.67	1.26	1.49
‘Bozoisky’ RWR	0.82	2.60	1.09	1.82	11	1.30	2.23	1.09	1.86
‘Oahe’ IWG	1.97	3.20	2.27	2.02	13	1.35	2.53	1.64	1.77
‘NewHy’ HWG	1.30	2.47	1.89	1.77	15	1.62	2.34	2.16	1.86
‘Hycrest’ CWG	1.55	3.11	1.36	2.13	16	1.74	2.78	1.29	2.43

<sup>1</sup>Mix #3: ‘Paiute’ + ‘Paddock’; #5: ‘Paiute’ + ‘Paddock’ + ‘Luna’; #7: ‘Paiute’ + ‘Paddock’ + ‘Manchar’; #8: ‘Paiute’ + ‘Paddock’ + ‘Luna’ + ‘Manchar’; #11: ‘Bozoisky’ + ‘Oahe’; #13: ‘Bozoisky’ + ‘Oahe’ + ‘NewHy’; #15: ‘Bozoisky’ + ‘Oahe’ + ‘Hycrest’; #16: ‘Bozoisky’ + ‘Oahe’ + ‘NewHy’ + ‘Hycrest’

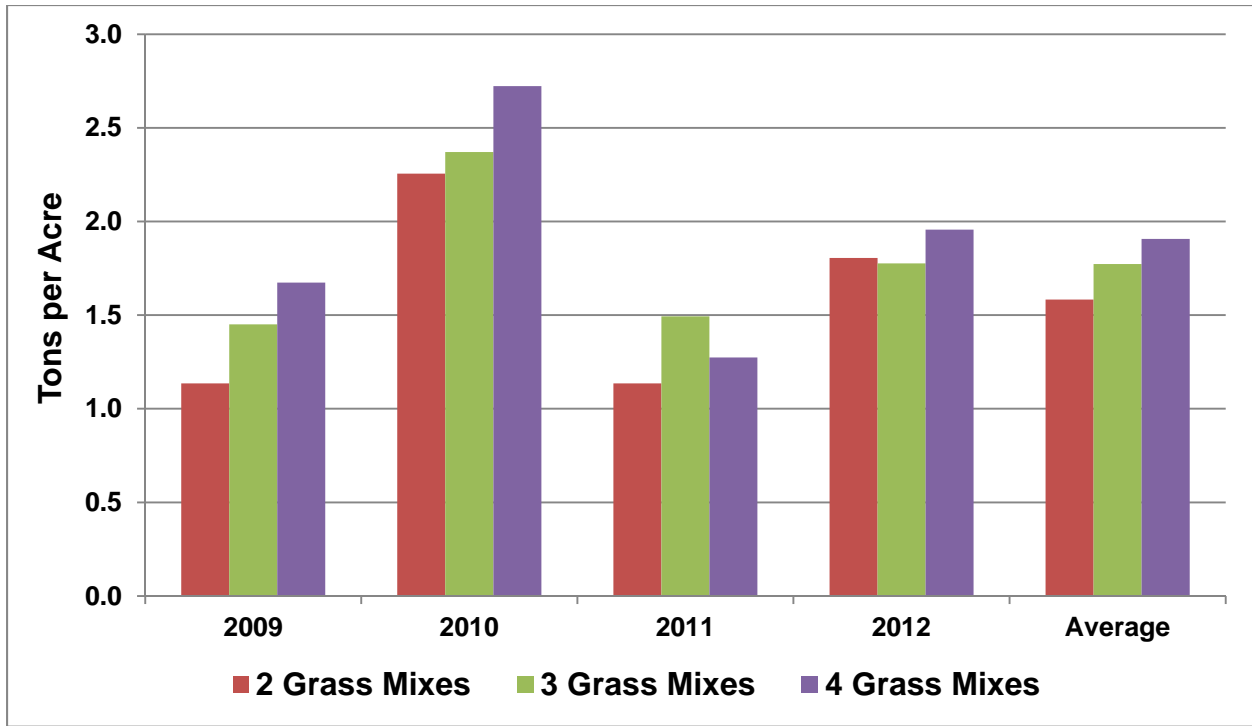


Figure 1: Average hay yields for the 2-grass, 3-grass, and 4-grass mixtures.

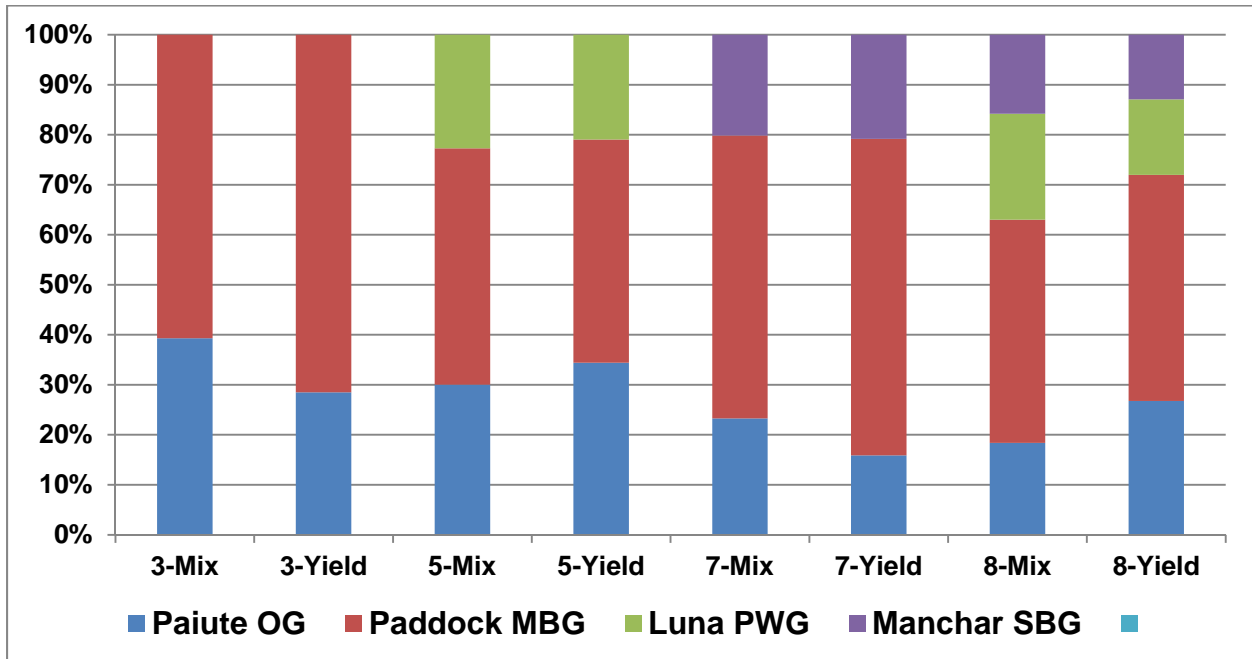


Figure 2: Amount each grass contributed to the low drought tolerant seed mixes (#) and the average amount (2009 – 2012) each grass contributed to the hay yields of these mixtures.

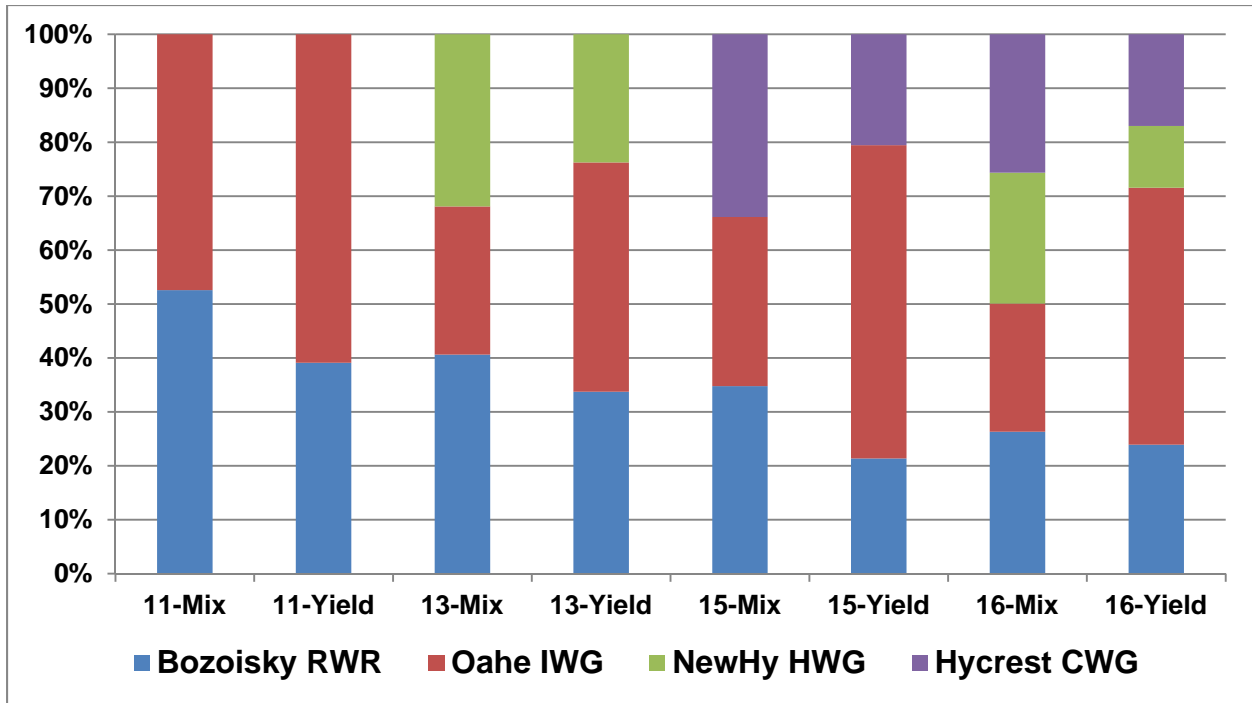


Figure 3: Amount each grass contributed to the high drought tolerant seed mixes (#) and the average amount (2009 – 2012) each grass contributed to the hay yields of these mixtures.

Table 2: Hay amounts in T/ac of each grass within the low drought (#3, 5, 7, and 8) and high drought mixtures (#11, 13, 15, and 16) in 2009, 2010, 2011, and 2012.

Low Drought	2009	2010	2011	2012	High Drought	2009	2010	2011	2012
'Paiute' OG	0.23	0.49	0.38	0.70	'Bozoisky' RWR	0.31	1.18	0.45	0.67
'Paddock' MBG	0.84	1.82	0.83	1.05	'Oahe' IWG	1.17	1.05	0.66	1.19
'Paiute' OG	0.43	0.61	0.37	0.84	'Bozoisky' RWR	0.19	0.95	0.61	0.70
'Paddock' MBG	0.45	1.53	0.43	0.51	'Oahe' IWG	0.89	0.69	0.66	0.86
'Luna' IWG	0.64	0.15	0.15	0.43	'NewHy' HWG	0.26	0.89	0.36	0.22
'Paiute' OG	0.19	0.37	0.19	0.30	'Bozoisky' RWR	0.23	0.61	0.50	0.36
'Paddock' MBG	0.48	1.70	0.88	1.09	'Oahe' IWG	0.91	1.31	1.27	1.13
'Manchar' SBG	0.65	0.25	0.15	0.31	'Hycrest' CWG	0.48	0.42	0.37	0.36
'Paiute' OG	0.36	0.56	0.38	0.58	'Bozoisky' RWR	0.15	0.98	0.36	0.48
'Paddock' MBG	0.33	1.75	0.59	0.52	'Oahe' IWG	0.62	1.19	0.62	1.49
'Luna' IWG	0.53	0.11	0.15	0.26	'NewHy' HWG	0.27	0.31	0.17	0.20
'Manchar' SBG	0.39	0.25	0.14	0.13	'Hycrest' CWG	0.69	0.30	0.15	0.26

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