

Statistical precision of a replicated farm grazing trial versus replicated paddock trials

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Introduction The experimental unit for animal average daily gain (ADG) and gain/ha in grazing trials is the paddock. Grazing trials on research stations often are conducted using small paddocks because animal and land costs restrict the number of treatments, replicates, and animals per paddock. Land and animal restrictions can be reduced by conducting trials on farms using animals provided by cooperating farmers. Farmers typically want only a single replicate on their farms and as result, virtually all on-farm trials in the USA and elsewhere have been un-replicated demonstration trials from which estimates of experimental error cannot be obtained. Farms can be used as replicates but concerns about statistical precision and the ability to detect treatment differences to date has limited the use of this design in the USA to a single study which we conducted in the Central Great Plains in the 1990's. Our objective is to compare the statistical precision of this on-farm grazing trial with replicated paddock trials on research stations in the same geographical region.

Materials and methods An on-farm grazing trial in which farms were replicates was conducted in north central Nebraska using three farms in different counties (Bauer *et al.*, 1995). Two cultivars each of smooth bromegrass (*Bromus inermis* Leyss.), intermediate wheatgrass, western wheatgrass (*Pascopyron smithii* (Rydb.) Löve) and one cultivar of crested wheatgrass were evaluated. Strains of switchgrass (*Panicum virgatum* L.), crested wheatgrass (*Agropyron* spp.), and intermediate wheatgrass (*Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey) were evaluated in replicated, paddock trials by Anderson *et al.* (1988), Vogel *et al.* (1993) and Moore *et al.* (1995), respectively, in eastern Nebraska (Table 1). In all trials, one-year-old (yearling) beef cattle were used as the tester animal. Standard errors were used to compare statistical precision among trials.

Results Standard error of the mean for both average daily gain and gain per ha were lower in the on-farm trial than in any of the replicated small paddock trials (Table 1). Because of their larger size, paddocks in the on-farm trial were stocked by more animals which reduced the experimental variation for animal gain and gain per hectare. Paddock size and number of animals also had an effect on SE's in the research station trials.

Table 1 Standard errors (SE) for average daily gain (ADG) and gain/ha for beef yearlings in replicated paddock trials versus an on-farm trial in which farms were replicates. All trials were conducted in Nebraska, USA

Trial	Duration (years)	Replicates (n)	Treatments (n)	Paddock size (ha)	Cattle/paddock	SE (mean) ADG (kg)	SE (mean) gain/ha (kg)
Res. station trials							
Anderson <i>et al.</i>	3	4	3	0.4	3 to 4	0.07	13
Vogel <i>et al.</i>	3	4	2	0.8	4	0.04	8
Moore <i>et al.</i>	2	3	4	0.4	3	0.07	20
On-farm trial							
Bauer <i>et al.</i>	2	3	7	2.5 to 3.2	12 to 24	0.02	6.5

Conclusions Well-managed grazing trials in which farms are replicates can provide greater statistical precision than small paddock trials on research stations. To be successful, trials should have clear objectives, test a small number of treatments and farmers must participate in the management of the trials.

References

- Anderson, B., J.K. Ward, K.P. Vogel, M.G. Ward, H.J. Gorz & F.A. Haskins. (1988). Forage quality and performance of yearlings grazing switchgrass strains selected for differing digestibility. *Journal of Animal Science*, 66, 2239-2244.
- Bauer, D., L.E. Moser & K.P. Vogel (1995). Grazing evaluation of cool-season grasses in the Nebraska Sandhills in replicated ranch trials. *Agronomy Abstracts*, p. 165.
- Moore, K.J., K.P. Vogel, T.J. Klopfenstein, R.A. Masters & B.E. Anderson. (1995). Evaluation of four intermediate wheatgrass populations under grazing. *Agronomy Journal*, 87, 744-747.
- Vogel, K.P., B.C. Gabrielsen, J.K. Ward, B.E. Anderson, H.F. Mayland & R.A. Masters. (1993). Forage quality, mineral constituents, and performance of beef yearlings grazing two crested wheatgrasses. *Agronomy Journal*, 85, 584-590.