Africa RISING West Africa Project

Corralling, planting density and N fertilizer rate effect of soil, weed maize yield and income

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Key messages

- ✓ Small scale crop-livestock farming system dominates in sub-Sahara Africa.
- ✓ Farmers adopt different practices such as keeping animals overnight on fallow lands to deposit manure and urine (corralling), different cropping densities and apply organic and inorganic fertilizers to maximize crop yields and improve soil fertility.
- ✓ However, quantitative data on the interactions of these practices on crop yields, soil properties and vegetation resources is limited.

Objective(s)

- ✓ To identify and disseminate interaction effect of sheep and goats corralling (SDSG), maize plant density (MPD) and N fertilizer rate (NFR) to improve and intensify maize productivity in small scale maize-livestock system

Approach

- ✓ The Community-based Technology Park (TP) approach which is a researcher and farmer managed trials and also serves as demonstrational fields for farmers to learn good agronomic practices was used.
- ✓ A split-split plot design was used to evaluate the effect of three SDSG (0, 70 and 140 heads ha^{-1}), three MPD (66 667, 100 000 and 133 333 plants ha^{-1}) and three NFR (0-40-40, 60-40-40 and 90-40-40 NPK kg ha^{-1}).
- ✓ The sheep and goats were corralled from 19: 00 to 06:00 hours GMT the following day with no feed and water for 178 nights after grazing on communal pastures and crop residues during the day.

Key results

- ✓ Soil chemical and biological properties increased ($P<0.01$) as SDSG was raised from 0 to 140 heads ha^{-1} (Table 1).
- ✓ The SDSG had significant effect on weed species count (Fig. 1)
- ✓ The SDSG and NFR interaction increased ($P<0.01$) maize grain yield and net income by more than 75% (Table 2).

Conclusion

- ✓ Maize-livestock farmers without access to mineral fertilizer could corral sheep and goats at 70 or 140 heads ha^{-1} with for improved grain yield and net income.
- ✓ Those with access to mineral fertilizer could corral sheep and goats either at 70 heads ha^{-1} with mineral fertilizer at 90 kg ha^{-1} N or 140 heads ha^{-1} with mineral fertilizer at 60 kg ha^{-1} N to increase grain yield and net income on *Ferric lixisol* soils of Sudan savanna zone of Ghana and similar ecologies.

Main picture: maize plants in a field on which small ruminants were corralled, (inset) maize plants in a field where no small ruminant corralling was done.

Table 1. Soil properties as affected by SDSG

	SDSG (heads ha^{-1})					Contrast probability of F value	
Soil parameter	0	70	140	s.e	P-value	0 vs (70 + 140)	70 vs 140
pH (H_2O)	5.2	5.6	5.6	0.07	**	***	ns
OC (g kg^{-1})	8.3	13.8	16.6	0.59	***	***	**
Total N (g kg^{-1})	0.5	0.7	0.7	0.05	**	**	ns
Available P (mg kg^{-1})	2.2	3.3	3.1	0.19	**	**	ns
Exchangeable K (cmol kg^{-1}) x 10^{-2}	4.7	15.0	18.3	2.18	**	***	ns
C/N ratio	16.5	21.5	23.7	1.17	**	**	ns
Microbial biomass carbon (g kg^{-1})	250.9	343.8	368.6	9.54	***	***	ns
Microbial biomass nitrogen (g kg^{-1})	20.8	24.0	24.1	0.86	**	**	ns
Soil microbial quotient (%)	2.6	3.0	3.0	0.09	**	**	ns
Earthworm cast (0.25 m^{-2})	9.0	15.7	20.5	0.79	***	***	**

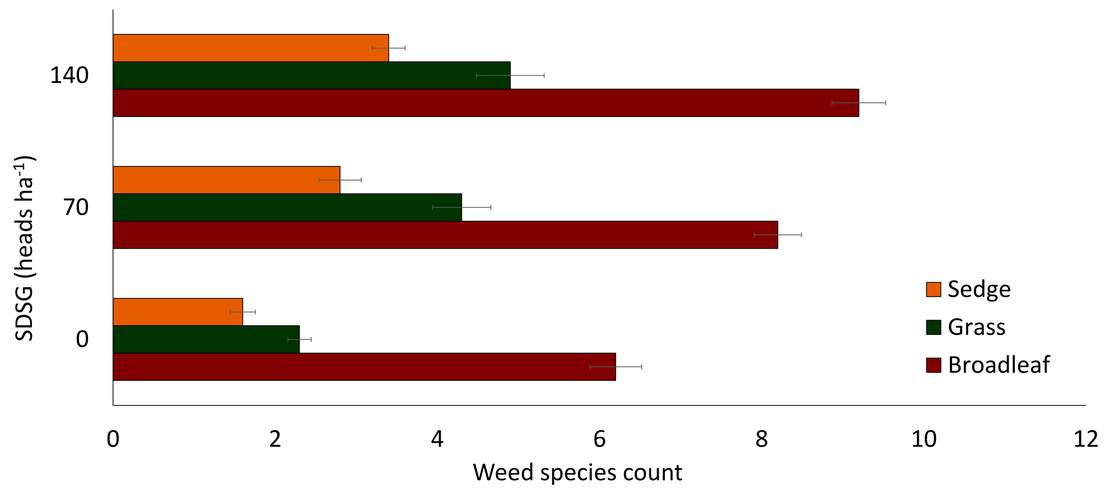

Fig. 1. Weed species count as affected by SDSG

Table 2. SDSGxNFR effect on maize grain yield and net income

SDSG (heads ha^{-1})	NFR (kg ha^{-1})	Grain yield (kg ha^{-1})	Income ($ ha^{-1})
0	0	678.2	-67.5
	60	1285.0	22.6
	90	1428.2	8.1
70	0	1241.9	57.1
	60	2252.5	252.8
	90	2675.0	311.2
140	0	1409.4	93.6
	60	2563.0	324.8
	90	2856.1	349.5
s.e		104.50	27.31
P-value		**	**
Contrast probability of F value			
0*0 vs (70*0 + 140*0)		***	***
70*0 vs 140*0		ns	ns
0*60 vs (70*60 + 140*60)		***	***
70*60 vs 140*60		*	*
0*90 vs (70*90 + 140*90)		***	***
70*90 vs 140*90		ns	ns

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