Energy conversion of crop production systems with winter annual pastures under no-tillage

Henrique Pereira dos SANTOS[1]*, Renato S. FONTANELI[1], Anderson SANTI[2], Ana M. VARGAS[3], Amauri C. VERDI[3]

[1] Embrapa Trigo, Rod. BR 285, Caixa Postal 3081, 99050-970 Passo Fundo, RS, Brazil. Bolsista em Produtividade do CNPq. [2] Embrapa Trigo, Passo Fundo, RS, Brazil; [3] Acadêmico de Agronomia da UPF, Rod. BR 285, Caixa Postal, 99001-000, Passo Fundo, RS, Brazil. Bolsista de Iniciação Científica do CNPq.
E-mail address of presenting author*: henrique.santos@embrapa.br

Introduction

Production systems without crop rotation, based on agrochemicals, cause reduction in energy efficiency due to the small cover crop, coupled with the heavy reliance on external inputs. Management practices that reduce the problems outlined can be alternative to increasing the efficiency of crop production systems, especially by the use of crop rotations and management of species for green manure, cover crop, fixing N and carbon sequestration (Santos et al, 2011).

Material and Methods

The field trial was carried out at the Embrapa Trigo Research Center, in Coxilha county, RS state, for a period of 2009/10 to 2012/13. Treatments consisted of six crop-livestock production systems (CLPS): System I: wheat (W)/soybean (S) and common vetch (V)/corn (C) ; II: W/S and black oat pasture (BO)/C; III: W/S and BO/S; IV: W/S and pea (P)/C; V: W/S, dual-purpose triticale (T)/S and V/S; and VI: W/S, dual-purpose white oat (WO)/S and dual-purpose wheat (Wd)/S. Energy obtainable was considered from grain yield, dry matter yield, amount of N in the dry matter and crop residues. Energy consumed was estimated based on amount of energy coefficients corresponding to the limestone, fertilizers, seeds, fungicides and insecticides used in each CLPS and spent energy of operations (sowing, fertilizing, spraying and harvest). Energy conversion results of the energy consumed by the division obtainable in each CLPS. Data were processed in MJ (kcal x 1,000 x 4.186).

Results and Conclusions

Table 1. Energy Conversion of six integrated crop-livestock production systems under no-tillage.

Production Systems	Energy conversion-livestock production systems (Mj/ha)				
Year	2009/10	2010/11	2011/12	2012/13	Average
System I (W/S e V/C)	75.77 a	80.17 a	45.66	58.10 a	64.92 a
System II (W/S e BO/C	51.42 b	52.00 c	34.92	46.50 ab	46.21 b
System III (W/S e BO/S)	45.53 b	45.23 c	31.94	32.64 b	38.84 b
System IV (W/S e P/C)	73.98 a	72.08 ab	39.75	55.99 a	60.45 a
System V (W/S, T/S e V/S)	52.98 b	61.60 bc	32.31	36.46 b	45.84 b
System VI (W/S, WO/S e Wd/S)	46.21 b	48.76 c	35.20	33.24 b	40.85 b
Average	56.50 A	59.29 A	36.62 B	43.82 B	49.51
C.V. (%)	29	31	30	35	-
Significance level	**	**	ns	**	**

Values within a column followed by the same lower case letter or in the same row followed by the same capital letter, are not different ($P>0.05$) by Tukey. Ns: not significant; ** Significant at the 0.01level.
W=wheat; S=soybean; V=common vetch; C=corn; BO=black oat pasture; P=pea; T=dual-purpose triticale; WO=dual-purpose white oat; Wd= dual-purpose wheat.

Corn crop stood out as greater energy return, compared to other grain crops and winter pastures. Among the soil cover crops and green winter fertilization and vetch was the most efficient in energy conversion. Systems I and IV were the most efficient in energy conversion. Integration of crop livestock production systems, under no-tillage was feasible and show positive energy conversion.

References cited

Santos et al. (2011) Pesq. Agropec. Bras.