world congress on integrated crop-livestock-forest systems
3rd International Symposium on Integrated Crop-Livestock Systems
towards sustainable intensification • brasília • brazil • 2015

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

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Introduction

Inputs and services used in crop rotation or crop production systems represent energy costs. Depending on these components and grain or dry matter yields, the energy expenditure will determine the efficiency of energy conversion of production systems. If the energy produced is less than the energy consumed, the energy balance is negative (Santos et al., 2010).

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 balance is the difference between the power obtainable and consumed in each CLPS. Data were processed in MJ (kcal x 1,000 x 4.186).

Results and Conclusions

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

Production System	Energy balance of crop-livestock production systems (MJ/ha				
Year	2009/10	2010/11	2011/12	2012/13	Average
System I (W/S e V/C)	194.194 ab	201.651 ab	148.319 bc	196.011 ab	185.044 b
System II (W/S e BO/C)	217.294 a	212.772 a	164.148 ab	230.440 a	206.164 a
System III (W/S e BO/S)	166.882 bc	164.972 c	156.323 abc	170.070 b	164.562 c
System IV (W/S e P/C)	184.054 bc	184.503 bc	128.601 c	194.836 ab	172.998 bc
System V (W/S, T/S e V/S)	160.367 c	180.843 bc	146.308 bc	172.554 b	165.018 c
System VI (W/S, WO/S e Wd/S)	169.353 bc	181.039 bc	182.999 a	176.472 b	177.466 bc
Average	182.024 A	187.630 A	154.450 B	190.064 A	178.542
C.V. (%)	15	14	19	19	-
Significance level	**	*	**	**	**

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. * Significant at the 0.05 level. ** Significant at the 0.01 level.
W=wheat; S=soybean; V=common vetch; C=corn; BO=black oat pasture; P=pea; T=dual-purpose triticale; WO=dual-purpose oat; Wd= dual-purpose wheat

Crop corn stood out as greater energy return, compared to other grain crops and winter pastures. System II (wheat/soybean and black oat pasture/corn) was the most efficient in energy balance. Integration of crop and livestock production systems, under no-tillage was feasible and show positive energy balance.

References cited

Santos et al. (2010) R. Bras. Ci. Agrárias.