

广东惠阳水稻种植中耕牛与小型拖拉机使用的能值比较

Emergy based comparison of farm cattle and tractor system on rice planting in Guangdong: A case study of the typical famers in Huiyang District

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中文摘要:

以能值理论方法为手段, 从资源的投入和输出结构角度, 对广东省惠州市惠阳区典型水稻种植户的耕牛和小型拖拉机这两种典型的农业驱动力产出系统的转化与生产效率, 环境负载和可持续性进行比较分析与评价。研究表明: 耕牛系统在单位面积水稻田上消耗的不可更新资源量是拖拉机系统的4.57倍; 人力能值消耗是拖拉机系统的6.14倍。相对于拖拉机动力, 耕牛产出动力处于较低的能量等级, 其环境负载率(ELR)仅是拖拉机系统的24%, 可持续能值指标(ESI)是拖拉机系统的4.25倍, 但有巨大的优化空间和可能。而广东小型拖拉机系统产出驱动力的使用效率则稍高于典型65 kW拖拉机系统。从提高能值效率角度分析, 减少耕牛系统生产过程中过多的人力投入, 着力提高耕牛系统产出驱动力的利用效率比发展小型拖拉机系统更有潜力。生产过程中的人力投入和使用过程中的维护投入是农机驱动力产出系统不可忽视的能值投入项。

英文摘要:

Based on emergy theory and synthesis method, and investigation data of typical rice planting farmers in Huiyang District, Huizhou City of Guangdong Province as the case, an ecological economic evaluation and comparison was made on farm cattle system and pint-size tractor system which are two kinds of typical agro-traction system in China, from resources structure, transfer and production efficiency, environment loading and sustainability. The emergy based accounting function of mechanical motivity was optimized, and a new emergy transformity of tractor motivity was given out based on this study. Some of their emergy indices were compared with those of horse and tractor in Swedish agricultural system. The result shows that farm cattle system consumes 4.57 times' non-renewable resources and 6.14 times' labor resource that of tractor system on unit rice paddy. Compared with tractor traction, the output impetus of farm cattle is on a lower level in the energy hierarchy. The ELR of cattle traction is only 24% of the tractor system, and its ESI is 4.25 times that of tractor system, while the current energy efficiency of cattle traction in plough production is only 3% that of tractor impetus, and 1.98% that of horse system in Swedish agricultural system. That means there is large room to improve the efficiency of farm cattle traction. The efficiency of use pint tractor traction in Guangdong rice paddy is higher than that of 65 kW tractor system in Swedish agricultural system. To improve emergy efficiency, there is much more space to optimize farm cattle traction system than pint tractor traction system, by decreasing extra labor cost and increasing the use efficiency of its tractor output. Labor and maintenance cost during the production and use process of tractor were unneglectable emergy input of tractor system.

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