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**Economic Feasibility of Small Scale Organic Production of Rice, Common Bean and Maize in Goiás State, Brazil<sup>a</sup>**

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**Abstract**

*The increasing demand for healthy food and the need for environmental and economic sustainability of agricultural production are promoting organic farming worldwide. Therefore, agricultural researchers are challenged to develop such systems together with the stakeholders. In Brazil, scientists are testing different farming systems to produce organic food. However, the economic feasibility, which is a key factor for technology adoption and sustainable production, has not been analysed so far. This paper assesses the economic feasibility of small scale organic production of rice, common bean and maize in Goiás State, Brazil. During 2004/05 and 2005/06 growing seasons, rice, common bean and maize were produced at the organic farm of Embrapa Rice and Beans under five mulching systems, with and without tillage. All carried out operations and used inputs were recorded. Based on those records, the production costs for each crop were estimated in each cropping season. The costs include operations like seeding, dissection, ploughing, harrowing, spraying and harvesting, as well as inputs like seeds, inoculates, neem oil and organic fertilisers. The benefits include the gross revenue obtained by multiplying the production amount with the market price for non-organic products. For the purpose of analysis of competitiveness of organic production in comparison to conventional farming the market prices assumed were those of conventional production. In the analysis, the costs of certification were not considered yet due to lack of certifiers in the region. For comparison between traits, the benefit-cost-ratio (BCR) was used. In 2004/05 growing season the BCR varied from 0.27 for common bean on sorghum mulch system with tillage up to 4.05 for green harvested maize produced after Crotalaria in no tillage system. Common bean and rice were not economically viable in this growing season. In 2005/06 growing season the BCR varied between 0.75 for common bean after sorghum in tillage system and 4.50 for green harvested maize produced after fallow in no tillage system. In this season common bean was economically viable in leguminous mulching systems and green harvested maize was viable in all mulching systems.*

## **1 Background and Objective of the Study**

The increasing demand for healthy food and the need for environmental and economic sustainability of agricultural production are promoting organic farming worldwide. Therefore, agricultural researchers are challenged to develop such systems together with the stakeholders. In Brazil, scientists are testing different farming systems to produce organic food. However, the economic feasibility, which is a key factor for technology adoption and sustainable production, has not been analysed so far. Therefore, the main objective of this study was to assess the economic feasibility of small scale organic production of rice, common bean and maize in Goiás State, Brazil.

## **2 Methods**

During 2004/05 and 2005/06 growing seasons, upland rice, common bean and maize were produced at the organic farm of Embrapa Rice and Beans under five mulching systems (fallow, *Crotalaria sp.*, *Cajanus cajan*, *Mucuna sp.* and sorghum), with and without tillage. All carried out operations and used inputs were recorded. Based on those records, the production costs for each crop were estimated in each cropping seasons. The costs include operations like seeding, dissection, ploughing, harrowing, spraying and harvesting, as well as inputs like seeds, inoculates, neem oil and organic fertilisers. The benefits include the gross revenue obtained by multiplying the production amount with the market price for non-organic products, as there are no established certification procedures for organic production in the study region. Thus, for the purpose of analysis of competitiveness of organic production in comparison to conventional farming, the market prices assumed were those of conventional production. In the analysis, the costs of certification were not considered yet due to lack of certifiers in the region. For comparison between trials, the benefit-cost-ratio (BCR) was used.

## **3 Results and Discussion**

After estimating the production costs and the gross revenue for each crop on each cropping system (with or without tillage; five mulching systems), its Benefit-Cost-Ratio (BCR) was calculated. The results of BCR are presented in Table 1.

Common bean had a better economic performance in cropping season 2005/2006 than in 2004/2005. While in 2004/2005 none of the common bean trials achieved BCR above 1.0, in 2005/2006 all trials under leguminous mulching (*Crotalaria sp.*, *Cajanus cajan* and *Mucuna sp.*) reached BCR of 1.13 and above. In 2005/2006 also on fallow area with tillage the BCR was positive. Sorghum as mulch for common bean production was not a viable option in none of the two years considered (Table 1).

The upland rice production had the worst performance in organic farming. In 2004/2005 only in tillage systems its harvest was justified by yields and the BCR were all below 0.57. The low yields achieved under the considered conditions were the cause of bad insufficient economic performance (Table 1).

The green maize production achieved the highest BCRs, varying from 1.77 after sorghum mulch in year 2004/2005 up to 4.50 after fallow in year 2005/2006. Thus, green maize production was viable under all considered systems (Table 1).

When harvesting maize as grain, all systems under leguminous mulching, with or without tillage, were economically viable, with BCR varying from 1.15 up to 1.93. The fallow system was only viable with tillage in 2004/2005 and without tillage in 2005/2006. Sorghum was not economically viable as mulch for grain maize production (Table 1).

Table 1. Benefit-Cost-Ratio of organic production of common bean (*Phaseolus vulgaris*), upland rice (*Oryza sativa*) and maize (*Zea mays*) under five mulching systems with and without tillage in cropping seasons 2004/2005 and 2005/2006.

Crop	Tillage (with/without)	Season	Benefit-Cost-Ratio in different mulching systems				
			Fallow	Crotalaria sp.	Cajanus cajan	Mucuna sp.	Sorghum
Common beans	With	2004/2005	0.32	0.48	0.39	0.34	0.27
		2005/2006	1.40	1.13	1.19	1.13	0.75
	Without	2004/2005	0.54	0.75	0.63	0.67	0.45
		2005/2006	0.99	1.17	1.28	1.27	0.84
Upland rice	With	2004/2005	0.36	0.56	0.44	0.27	0.14
		2005/2006*	-	-	-	-	-
	Without	2004/2005*	-	-	-	-	-
		2005/2006*	-	-	-	-	-
Green maize	With	2004/2005	3.37	3.32	4.05	3.74	2.05
		2005/2006	3.87	3.08	3.57	3.75	2.04
	Without	2004/2005	3.23	4.08	2.60	4.17	1.77
		2005/2006	4.50	3.64	3.66	4.07	2.23
Grain maize	With	2004/2005	1.30	1.25	1.28	1.15	0.42
		2005/2006	0.95	1.22	1.38	1.52	0.40
	Without	2004/2005	0.87	1.33	1.24	1.55	0.51
		2005/2006	1.27	1.15	1.31	1.93	0.59

\* Yields were too low to justify harvesting.

The differences in economic performance between green and grain maize arise from revenue side, considering the higher yields and the market prices for green maize, as the production costs are similar to grain maize.

Obviously the economic performance of each crop would be increased when consumers are willing to pay more for organic products. In this case, the costs of certification would also increase the production costs.

#### 4 Conclusions

Organic farming can be a viable option, even if the producer prices are the same than those of conventional food.

Upland rice was not economically viable under the considered conditions.

Organic common bean production was economically feasible only the second of the two considered years and mainly in leguminous mulching systems.

Maize had the best economic performance under all considered options and cultivation systems. The best results were obtained with green maize cultivated in leguminous mulching systems.

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