

The influence of contracts on smallholder pepper (*Piper nigrum* L.) producers in Costa Rica under different market conditions

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The influence of contracts on smallholder pepper (*Piper nigrum* L.) producers in Costa Rica under different market conditions.

Abstract – Introduction. Costa Rica's pepper production (*Piper nigrum* L.) is relatively low, but for the farmers involved it presents an interesting cash cropping activity. This paper aims to analyse whether contracts with processing firms offer an incentive for farmers to invest in pepper production and thereby increase their income. We analysed the characteristics of farmers with formal and informal contracts to see if this influences their way of producing pepper, their yields and income. The second goal of our work was to study whether market conditions (one or more buyers) influence contract uptake and pepper production. **Materials and methods.** A survey was conducted in 2000 among 63 farmers, 32 of whom had access to only one buyer and 31 of whom could sell to three potential purchasers. Characteristics of farmers, farms and pepper production were compared in terms of market conditions and forms of contract. A subsample of 24 farmers was revisited in 2008. **Results.** Overall, the effects of contracts in terms of improving access to inputs and increasing yield and productivity were limited. However, formal contracts were endorsed by income-constrained farmers, especially in the early phase of establishing themselves in the market. In subsequent phases, and under more competitive market conditions, producers seemed to prefer verbal commitments to formal contracts. In situations where a monopsony situation prevailed, there were lower yields. **Conclusion.** Contracts are important in the start-up phase, and competitive market conditions favour a process of moderate intensification which stimulates high returns at relatively low costs to the most established pepper producers.

Costa Rica / *Piper nigrum* / production economics / supply balance / marketing channels / remuneration / incentives

Influence des contrats sur les petits cultivateurs producteurs de poivre (*Piper nigrum* L.) au Costa Rica sous différentes conditions de marché.

Résumé – Introduction. La production de poivre (*Piper nigrum* L.) du Costa Rica est relativement basse, mais, pour les fermiers impliqués, elle présente une activité financière intéressante. Cet article vise à analyser si les contrats signés avec des entreprises de transformation sont aptes à inciter les fermiers à investir dans la production de poivre et à augmenter de ce fait leur revenu. Nous analysons les caractéristiques des fermiers liés avec des contrats formels ou non afin d'évaluer si cela influence leur façon de produire le poivre, leurs rendements et leur revenu. Le deuxième objectif de notre travail a été d'étudier si les conditions du marché (avec un ou plusieurs acheteurs) influençaient la prise d'un contrat et la production de poivre. **Matériel et méthodes.** Une enquête a été menée en 2000 parmi 63 fermiers, dont 32 avaient accès à seulement un acheteur et 31 avaient à faire à trois acheteurs potentiels. Les caractéristiques des fermiers, de leurs exploitations et de la production de poivre ont été comparées en fonction des conditions du marché et des formes de contrat. Un sous-échantillon de 24 fermiers a été revisité en 2008. **Résultats.** De façon générale, l'effet des contrats vis-à-vis de l'amélioration à l'accès aux intrants et vis-à-vis de l'augmentation des rendements et de la productivité a été limité. Cependant, des contrats formels ont été signés par les fermiers contraints à récupérer des revenus, particulièrement dans la phase de leur premier établissement sur le marché. Dans des phases suivantes, et dans des conditions de marché plus concurrentielles, les producteurs ont semblé préférer des engagements verbaux aux contrats formels. Dans les situations où une situation de monopsonie a régné, les rendements ont été moindres. **Conclusion.** Les contrats sont importants pour la phase de démarrage de la production, et les conditions de marchés concurrentiels favorisent une dynamique d'intensification modérée qui favorise de hauts retours pour des coûts relativement bas pour les producteurs de poivre les mieux établis.

Costa Rica / *Piper nigrum* / économie de production / offre et demande / circuit de commercialisation / rémunération / incitation

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Received 19 September 2008
Accepted 25 March 2009

Fruits, 2009, vol. 64, p. 371–382
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DOI: 10.1051/fruits/2009033
www.fruits-journal.org

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1. Introduction

Contract farming can overcome, or at least considerably reduce, problems caused by market failures, by providing a better institutional environment and integrating primary producers into agricultural supply chains.

In general, contracts can be classified into three categories, although these are not mutually exclusive: (a) market specification contracts these are simple pre-harvest arrangements that provide a market outlet for the farmer [1]; (b) production management contracts: the farmer is required to adopt specific growing practices, input regimes and post-harvest management practices under the technical supervision of the buyer, and (c) resource-providing contracts: the buyer provides a market outlet for the farmer's production, delivers specialised input packages and supervises the production process [1–4].

Contract farming is seen as offering a promising mechanism for incorporating small-scale and low-income farmers into the market economy [5, 6]. Various studies on contract farming in developing countries have been published [4–7], including a recent literature review on the role of contracts in improving small-scale farmers' access to supermarket systems [8, 9]. Contract farming is usually seen as a substitute for poorly functioning or absent markets and as a means of improving the overall competitiveness of the agricultural sector and reinforcing its contribution to economic growth [10]. In the New Institutional Economics literature, contracts between farmers and a processor are considered as one among several possible governance arrangements that can reduce transaction costs, given the asset specificity of the production system, level of output and institutional environment [10, 11]. Under such contracts, the processor provides specialised planting material, inputs and technical services to the producers, while the farmer provides land and labour [12]. Such contracts are thought to be particularly interesting to processors purchasing labour-intensive commodities as they allow them to take advantage of the skilled, flexible and dedicated labour on family farms [6, 12].

Having a contract, however, does not automatically mean that all the problems associated with high transaction costs will be completely resolved [13]. Some studies have shown that contracts may have negative implications for local social relations and can lead to a loss of autonomy and bargaining power [4, 6, 14]. Sivramkrishna and Jyotishi [15] highlight concerns about the fairness of distribution of benefits between farmers and processors, especially in the case of monopsonistic buyers in developing countries [15]. Their analysis may explain why some farmers prefer not to enter into contractual arrangements and/or why contracting may have little effect on the farming business and why multiple failures among contract farming systems have been reported in developing countries [5, 7, 10].

In Costa Rica, poor smallholders lack competitiveness vis-à-vis larger producers who are better integrated into the market [16]. Rural Costa Rica faces high transaction costs and information problems which both influence farmers' decision-making. Agrarian policies have continuously promoted an open market economy and have not taken into account the effects of such policies on the less developed peasant sector [17, 18]. In response to the problems of high transaction costs and information problems, contract farming between agro-processing firms and farm households has recently emerged in Costa Rica [19]. There is, however, little research on the effects of contracts as an alternative market institution in Costa Rica.

In our paper, we present a study on the uptake of contracts and its role in stimulating an on-farm diversification strategy of producing pepper (*Piper nigrum* L.) in the north of Costa Rica. In Costa Rica, pepper is considered as a non-traditional cash crop which is traded in a niche market. The country's production is not significant on the world market, which is dominated by large producers such as India¹. Pepper production

¹ Other important producers are China, Malaysia and Thailand. It is estimated that production in India and Indonesia will continue to grow, as will exports from China and Vietnam, while production in Brazil, Malaysia and Thailand is expected to decrease [21]. One should, however, be aware of the lack of precise data on global pepper production [21].

was introduced in Costa Rica in the 1970s and by 1990 covered a mere 500 ha [20]. According to FAO Stat², the area of pepper harvested in Costa Rica in 2006 was barely 84 ha, which is very low compared with major producing countries such as India (224 000 ha), Indonesia (90 000 ha), Vietnam and Sri Lanka (48 000 ha each), and Brazil (32 500 ha). Although we use pepper daily to spice our dishes, the number of socio-economic studies on (smallholder) pepper production is rather scarce. We found an extensive overview by Nair on pepper production [21], but the focus of the paper's section on the economy is limited to presenting the statistics of major pepper producers. A noteworthy exception is a paper by Wadley and Mertz that describes the potential of pepper as a diversification crop for farmers in Indonesia, responding to price increases [22].

The Huetar Norte region is the most important area of production of pepper in Costa Rica. Pepper was promoted as a non-traditional crop in this area by the Institute of Agrarian Development (IDA) at the end of the 1980s. The introduction of pepper on smallholder farms was also promoted by the NGO CINDE (*Coalición Costarricense de Iniciativas de Desarrollo*), financed by USAID. Pepper production is highly labour-intensive, does not require complex technologies or machinery and can yield a valuable harvest per hectare. Pepper production can be considered as part of an on-farm diversification strategy by farmer households and contracts can play an important role in enhancing production and market opportunities [23].

At the time of this research, there were three processing companies in the Huetar Norte region. In one area, a single company was actively buying pepper, creating a monopsonistic market situation. In the other areas, there were three companies buying pepper, creating a competitive market situation. The processing companies had different types of deals with the farmers; some farmers had written contracts with one of the companies, while others had verbal con-

tracts or no contract at all. For farmers, a contract has the advantage of reducing the transaction costs of selling the produce and securing a buyer as well as gaining access to information, inputs and technical advice, all of which are important when starting pepper production. Pepper generally takes (1.5 to 2) years to the first harvest. Start-up costs for cuttings and material inputs add up to about US\$2 500 per ha (Mora, personal communication). For the buyer, contracts also reduce transaction costs and secure regular supplies. Transaction costs are reduced because the trading partners get to know each other, need less time to exchange information and come to trust each other more, reducing negotiation and monitoring costs [3, 10]. In Costa Rica, production costs and the costs of supplying the processor factory with fresh pepper are quite low and there is no local spot market. Moreover, pepper production is highly labour-intensive, so purchasers have little interest in vertical integration through having large plantations.

Against this background, our paper aims firstly to analyse whether contracts provide an incentive for, and/or enable, farmers to intensify pepper production and the effect that contract specifications have on pepper production and productivity levels. Secondly, the paper aims to assess how pepper production is affected by the market structure in which farmers find themselves.

It is difficult to generalise what determines small farmers' choice of contract. Key and Runsten [6] argue that farmers with few alternative production or income opportunities will be more likely to accept contracts, since they possess less bargaining power and have fewer alternative options. This may be particularly true for poor farmers with limited production assets, such as capital, family labour and land. Therefore, a first hypothesis tested in our study is whether farmers with more secure contracts have more incentives towards relatively higher levels of investment and hence secure higher pepper yields. However, the impact of the contractual arrangements also depends on the institutional environment and alternative opportunities. The second hypothesis therefore is that pepper production depends on market characteristics.

² Anon., FAOStat, Statistics, available from: www.fao.org, cited November 2007.

To test these hypotheses, we compared farmer groups with different contractual arrangements; they were surveyed in 2000–2001. Some farmers had contracts (mostly verbal, some written) to sell fresh pepper berries to a processor, others did not. The sample covered the monopsonistic and the competitive regions, which enables a comparison of the effect of both market situations on pepper production. A further subsample of farmers in Huetar Norte (in El Roble settlement) was revisited in 2008. El Roble lies in the part of Huetar Norte which had a competitive market in 2000. A comparison with the 2000 data provides insight into the evolution of pepper production since the original data was collected.

2. Materials and methods

2.1. Study areas

In Costa Rica, the marketing chain for pepper is fairly short. Farmers sell their harvest individually to wholesalers or processors who transform it into dried black or white pepper. Much of this pepper is exported. The local market mainly consists of food industries, which repack pepper for retailers or use it to spice processed food. A small portion of the processed pepper is directly sold to retailers or restaurants.

At the time of this research (production season 2000–2001) there were three main processors within the Huetar Norte region (Costa Rica), which we denote as companies A, B and C for reasons of simplicity and anonymity. These companies bought pepper from farmers either with verbal, or written, or no contracts. There was no regular spot market for pepper in Costa Rica, but, alongside these three companies, there was an unknown number of informal middlemen occasionally buying from farmers. In order to secure supplies these three companies depended on their formal and informal contacts with farmers.

Company A was the most technologically advanced processor. It specialised in the production of white pepper, most of which

was sold to a food processor in the capital, San José. It did not own a plantation and made both verbal and written contracts with farmers. Farmers under contract were obliged to strictly follow the company's technology advice. The written contracts guaranteed a minimal price, supply of seedlings to start the plantation and technical support. Farmers promised to supply pepper to the company for at least 15 years. If they breached their contracts, they would be obliged to repay the cost of the seedlings and other services. However, field experience showed that enforcement of these conditions was weak and no penalties were ever enforced. The verbal contracts were similar (except for the 15-year time-span). In this case, the farmers and company verbally agreed on delivery prices, which were linked to dollar exchange rates. Farmers were paid (8 to 15) days after delivery by cheque.

Company B was a smaller producer-processor. It owned a large pepper plantation but also bought from small producers to smooth out its supply to use its processing plant at maximum capacity. It processed black pepper for local and export markets. It contracted farmers verbally by offering a fixed price based on the local currency, which made it less attractive to farmers than the contracts of company A. However, the company offered interest-free credit for all inputs, farm gate collection and immediate payment at the farm gate (by cheque). Moreover, the technical requirements it imposed were less strict than those imposed by company A.

Finally, company C paid slightly higher prices, in cash and immediately at the farm gate. However, it did not offer any input supply or technical assistance. The company did not impose technical requirements.

The essential differences between the contracts provided by the companies lay in the product and process specifications. Written and verbal contracts with companies A and B included input delivery and technical assistance. The contracts closely resembled quasi-vertical integration based on long-term co-investment activities [1]. On the other hand, the verbal agreements provided by company C were strictly market-specification

contracts whose provisions were limited to price, delivery time and quantity. These made no specifications about the production process and were limited to product delivery specifications.

Since 2000–2001 both companies B and C have quit the pepper processing business. Company B switched its activities to the fruit business and is now processing noni (*Morinda citrifolia*). Company C finished its activities in the pepper market. It was a family-based enterprise with limited assets, limited managerial and marketing skills, basic technologies for processing black pepper and was poorly integrated into the domestic market for spices. As a result, company A currently has a monopsonistic position. This monopsony situation will change if another processing business enters the market, which is possible as Costa Rica's pepper production still has potential to grow. A few farmers now process their pepper themselves, directly selling their product to export companies.

2.2. Data

We used data collected from 63 producers in 2000 and 2001. We conducted a survey amongst pepper producers using a semi-structured questionnaire in which farmers were asked to give data on the characteristics of their household, farm and production system. The survey also included questions about market characteristics, farmer organisation and access to credit, inputs, technical assistance and market information. Each interview lasted an hour, on average, and included questions about the farmer's perception of the activity and the institutional setting. The survey covered about 65% of all pepper producers in the region. Because the identity and number of producers were unknown at the start of the research, snowball sampling procedures were used [24]. Maps of peasant settlements made by the Institute of Agrarian Development (IDA) and topographic maps from the National Geographic Survey Institute were used to identify the places where pepper is produced. Farmers within these locations were identified by using information from gov-

ernmental agronomists and technicians from the processing plants. After several rounds of field observation, a spatial distribution of pepper producers was made.

Thirty-two farmers were visited in a region where only company A was active. These farmers faced a monopsonic market situation. They could choose to contract with company A (verbal or written contracts) or to have no contract at all. Twenty-seven farmers had chosen a contract, with fourteen farmers having a written contract and thirteen farmers a verbal agreement.

The remaining thirty-one farmers operated in a competitive market and had the opportunity to sell to any of the three companies mentioned above. The division in this subsample was as follows: a single farmer had a formal contract, nineteen a verbal contract and the remaining eleven farmers had no agreement.

The impact of the contractual arrangements and the market situation was analysed by comparing farmers over the different categories; first by their contractual arrangement: formal, verbal and no arrangements; and, secondly, by their location in either a monopsonic or a competitive market situation. The characteristics of the farmers, farms and pepper production were compared against the contract arrangements using non-parametric Mann-Whitney tests for continuous variables and chi-square tests for categorical variables. The non-parametric Mann-Whitney tests were used to overcome the potential bias of sample sizes of less than 30 cases. The farmer groups were compared over the different market situations using t-tests.

The farm characteristics taken into account were farm size, the area planted with pepper and the share of the farm dedicated to pepper production. The managerial capacity of the farmers was evaluated by comparing the gross household income, the farmer's age, his experience in pepper production and education level. It is hypothesised that the higher the household income and the higher the farmer's experience and education level, the more likely he will be successfully investing in pepper production. The differences in managerial capacity of the farmers were also assessed by comparing

the income from pepper received per *manzana*³ by the different farmer groups. The importance of pepper as an income-generating activity was calculated as the share of pepper in total income. The level of access that farmers have to other sources of income was calculated from the share of income from non-agricultural income sources.

Access to markets was assessed through the average price that the farmers received for 1 kg of fresh pepper supplied, the rejection rates and their own assessment of access to input markets. Pepper is rejected by the processor when the berries are harvested when still immature or when they are damaged in storage or transport (by being exposed to sunshine or rain and/or piling on the truck). The quality of pepper is particularly important for company A, since 90% of its production is white pepper for industrial use, which requires top quality grains.

The productivity of pepper production was evaluated by comparing pepper production with the level of input use. As mentioned above, pepper production is very labour-intensive. Pepper plantations produce year-round, and there is a continuous demand for labour to select and pick the ripe berries. In addition, control of pests and diseases represents about 40% of total labour demand. The pepper plant, and especially its shallow root system, is highly susceptible to diseases [21]. Disease control is labour-intensive and needs to be done carefully, both to prevent damage to the roots and to control diseases before they can spread. Fungicides, herbicides and insecticides are used, but strict residue control measures make farms reluctant to apply them [19]. Fertilisers are more frequently applied [21]. Due to the superficial root system, a pepper plant requires loose, fertile and well-drained soils. In the survey, farmers were asked to estimate the use of labour (hours per week of family and hired labour extrapolated to annual labour use) and the use of fertilisers, pesticides, herbicides, fungicides and other inputs. Farmers were also asked to assess soil fertility (low, or medium to high) and whether they observed prob-

³ A *manzana* is about 0.7 ha.

lems with drainage and erosion of the fields (yes or no).

Secondly, a subsample of the farmers interviewed in 2000 was revisited in 2008. Twenty-four farmers in the El Roble settlement were asked similar questions as in 2000. Since 2000, a number of farmers had retired from the pepper business and some new pepper plantations had been started. The main characteristics of the farms between the 2000 and 2008 subsamples were compared.

3. Results

3.1. Comparison between different contractual arrangements

The comparison of farmers, farms and their production characteristics under different contractual arrangements shows that, in our case study, farmers produced pepper on a relatively small basis (*table I*). This crop is not their main one, but only supplements their income from other agricultural activities and non-farm sources. Pepper production presents for these farmers an opportunity to diversify their livelihood strategies by participating in a sector where they can benefit from considerable comparative advantages.

Formal contracts were preferred by less experienced producers with small farms. Farmers with formal contracts owned smaller farms than farmers with verbal contracts and without contracts. The share of land under pepper production of farmers with formal contracts was relatively higher than that of farmers without an agreement. Contrary to our expectations, these farmers reported a lower average income and a greater reliance on non-agricultural sources of income (although these differences could not be statistically confirmed). By comparison, farmers with verbal agreements were generally older, had less formal education and had been farming for considerably longer. Finally, farmers without any contractual arrangement had the largest farms and

were less reliant upon pepper production. They achieved the highest revenues from pepper, but it was not their main source of income.

The results indicate that farmers with less land endowments with limited farming experience preferred written or verbal contracts. Farmers with formal contracts seem to have made a choice to reduce risk during the establishment phase. Larger and more experienced farmers, on the other hand, preferred their independence and relied on more spot market-like exchange arrangements as a risk diversification strategy.

The analysis of the impact of contracts on the pepper production system (*table II*) shows that average pepper production and productivity levels were the highest among farmers without an agreement, although differences between the groups were not statistically confirmed. Farmers with verbal agreements seem to have older pepper plantations than farmers without a contractual agreement. They also used significantly more labour and chemical fertiliser as well as fungicides, herbicides and insecticides, compared with farmers without contractual arrangements. Overall, farmers without contracts spent less on purchasing inputs (both in absolute terms and relative to the size of the pepper plantation and the production of pepper) and viewed their land as being less fertile than farmers with a formal or verbal contract. The difference between farmers with formal and verbal contracts was not significant.

The results suggest that contracts provided a strong incentive for intensification of pepper production systems, but this had not (yet) led to higher productivity. Farmers with contracts generally operated smaller and more specialised fields. They also relied more on contract labour for pepper maintenance operations, since family labour was partly involved in non-farm and off-farm employment activities (although again the difference between the averages was not statistically significant). Farmers with contracts also spent more on chemical inputs, probably due to the relationship they have with the processor company and the larger share of their land devoted to pepper. The short-term yield effects derived from

improved access to credit and inputs provided by contracts seemed to be limited. More relevant are the indirect market-related incentives to increase investment in inputs and labour use for crop establishment and maintenance. Furthermore, in the absence of penalties, pepper farmers with delivery commitments displayed some disloyalty to their buyer in the competitive market situation. Most farmers continued to sell the major share of their harvest to their fixed buyer but also delivered small volumes to competitors.

3.2. Impact of the market situation

Data regarding the characteristics of households, farms and production under the different market situations reveals that farms in the competitive market were generally larger but less specialised in pepper production than farms in the monopsonistic market (*table III*). Farmers in the monopsonistic market were younger than farmers in the competitive market, but there was no statistical difference in their experience and education levels. Given the competitive nature of the market, farmers in the competitive market received a higher price for fresh pepper and, therefore, benefited more than those in the monopsonic market. Furthermore, they seem to use more labour on their pepper plots and take more care of the harvest. Hence, they also show a lower rejection rate than the farmers operating in the monopsonic market. The productivity of pepper production (per manzana) among this group was also higher. Thus, the competitive market structure seems to favour a process of moderate intensification, such as higher labour input, that offers higher returns.

3.3. Revisiting producers in the El Roble settlement

When studying the farm and pepper production characteristics of farmers in the El Roble settlement who were interviewed in 2000 and 2008 (*table IV*), it should be noted that the two samples do not contain exactly the same farmers, as some farmers quit pepper

Table I. Comparison of pepper smallholders, farms and their production characteristics under different contractual arrangements, including the absence of contracts, in Costa Rica (SD: standard deviation).

Contract type	Size of farm			Farmer managerial capacity				Market access			Dummy variables				
	Farm area (mz ²)	Area with pepper (mz ²)	Share of arable land under pepper (%)	Gross household income (US\$.y ⁻¹)	Age of household head (years)	Experience in pepper production (years)	Income from pepper (US\$.mz ⁻¹)	Income from pepper production (%)	Income from non-agricultural (%)	Price of pepper (US\$.kg ⁻¹)	Rejection rate (%)	Secondary education level	Good access to information	Good access to inputs	Good access to information
Formal	Means 15	19.8 (4.1) a,b**	1.15 (0.64)	10.5 (5.7) a**	7008.4 (5397.7)	44.3 (59.6)	4.3 (3.2) a**	1999.1 (2123.2)	33.8 (32.8)	41.0 (37.4)	0.94 (0.02)	11.16 (1.23)	64*	21	33
	SD														
Verbal	Means 32	20.7 (15.1) a**	1.26 (1.04)	8.6 (7.6) b**	7128.8 (4656.1)	49.3 (12.2)	7.1 (4.5) a,b**	1945.4 (1707.4)	33.5 (26.1)	27.8 (30.2)	0.95 (0.04)	10.68 (3.58)	38*	53	58
	SD														
No agreement	Means 16	52.6 (84.4) b**	1.51 (0.89)	6.6 (10) a,b**	8138.6 (6496.6)	46.5 (10.3)	7.9 (4.5) b**	2274.9 (3786.6)	24.9 (31.1)	33.7 (38.7)	0.96 (0.07)	9.84 (3.96)	69*	26	60
	SD														

1 mz: Manzana; 1 mz is about 0.7 ha. Mann-Whitney z-scores were calculated for continuous variables by comparing contractual arrangements two-by-two; a, b: used to indicate which contractual arrangements differ from each other. Chi-square scores were calculated for categorical variables; ** and * denote that the variable in the row is statistically different between the two types of contracts at a 5% and at a 10% significance level, respectively.

Table II. Effects of contracts on pepper production systems in Costa Rica (SD: standard deviation).

Contract type	Pepper yield (kg.y ⁻¹)	Age of the oldest pepper on the farm (years)	Productivity level (kg.mz ⁻¹ .y ⁻¹)	Total labour input (h.mz ⁻¹ .y ⁻¹)	Family labour (%)	Value of chemical fertiliser	Value of organic fertilisers	Value of fungicides, herbicides, insecticides	Value of other inputs	Value total inputs (US\$.y ⁻¹)	Dummy variables			
											Good fertility	Good drainage	Problem of soil erosion	
Formal	Means 15	2633 (1489)	2833.1 (2502.8)	25.3 (14.3)	85.2 (22.5)	245.9 (384.8) a*	4.4 (9.6)	142.0 (110.0) a**	2.9 (6.3)	305.9 (199.5)	0.20 (0.19)**	100*	60	53
	SD													
Verbal	Means 32	2991 (2770)	2456.5 (1975.9)	36.6 (28.4)**	88.2 (29.3)	205.8 (197.4) b**	30.3 (71.1)	184.4 (238.3) b*	8.0 (23.7)**	429.5 (496.7)**	0.49 (1.12)	81*	72	28
	SD													
No agreement	Means 16	3138 (2331)	4150.8 (5019.5)	24.9 (34.0)**	91.3 (14.7)	85.9 (99.9) a*,b*	5.6 (15.5)	61.4 (68.1) a**,b*	0.0 (0.0)**	226.4 (233.1)**	0.15 (0.25)**	69*	71	27
	SD													

mz: Manzana; 1 mz is about 0.7 ha. Mann-Whitney z-scores were calculated for continuous variables by comparing contractual arrangements two-by-two; letters a and b are used to indicate which contractual arrangements differ from each other. Chi-square scores were calculated for categorical variables; ** and * denote that the variable in the row is statistically different between the two types of contracts at a 5% and at a 10% significance level, respectively.

production in this period, others retired and new farmers started producing pepper. This explains why there was a statistical difference between the two samples in the farm size, although not in the average age of the farmers. The area in pepper production had increased, as had the share of arable land under pepper production. However, there was no statistical difference between the two samples in terms of pepper yields and productivity. This could be partly because some farmers in the second sample had only recently started to grow pepper and the young pepper plants had not yet reached high levels of production.

It is remarkable that the price paid to the farmers per kg of pepper was lower in 2008 than in 2000. This is because the contracts of the El Roble farmers with the monopsonistic buyer guaranteed a price in *colones*, which is linked to the dollar exchange rate (100 *colones* of Costa Rica \approx 0.17 US\$). However, rejection rates had decreased. This may be due to the pepper farmers' organisation that was established in El Roble, which groups the farmers in a single contractual arrangement with the monopsonistic buyer. This group was established to increase the bargaining power of the farmers [15]. The farmers' organisation had also increased controls at the collection point and prevented or reduced the delivery of immature peppers. Analysing the functioning and the impact of the farmers' group is, however, beyond the scope of this paper.

4. Conclusions

Our study analysed the market structure for pepper producers in the northern region of Costa Rica. Particular attention was given to the impact of contractual arrangements and the market situation on farmers' production systems and output. The analysis only partly confirms our first hypothesis, according to which farmers with contracts invest relatively more in pepper production. However, this does not result in higher pepper yields. Our second hypothesis was confirmed, as we found differences in the outcomes between farmers in the monopsonistic and in the competitive market regions.

The analysis of contract choice indicated that farmers with limited experience and smaller farms were more likely to engage in contracts in the early phase of establishing their pepper plantation. The benefits of this are most probably receiving planting material, inputs and advice but also providing a guarantee for their investment efforts. In subsequent phases, and under more competitive market conditions, producers preferred verbal commitments to written contracts. Contracts seem to fulfil different roles during the farm household's life cycle and are shaped differently under various market conditions.

The finding that farmers with more land seem to prefer not to enter into contracts may be a result of their initial motivation for investing in pepper. In general, they seem to earn enough from other agricultural production and diversify into pepper by choice. They find a market opportunity they want to grasp and they have sufficient funds and land to allocate to pepper without taking too much risk. They don't need a contract to be confident of accessing a market. Smaller-scale farmers, on the other hand, seem to diversify out of necessity and need the contracts to pay for the initial investment and ensure a regular buyer for their pepper. Labour is their main available resource.

The effect of contracts under different market situations indicates that a local monopsony may generate quite perverse incentives for making fixed investment in pepper plantations compared to situations where there is competition between buyers. We recorded yields per hectare that were substantially lower in the monopsony region, even when farmers used more inputs. However, a local monopsony can facilitate a transition towards more capital-intensive production systems, especially when it provides contractual regimes that provide resources and (temporarily) reduce input costs. It seems that the situation did not change between the two survey periods and processing firm A was not able to recruit many new pepper growers.

A number of issues merit further study. The current data does not explain a number of causalities; we described the choice of

Table III. Effects of market situation on pepper production systems in Costa Rica (SD: standard deviation).

Type of market	N	Size of farm			Farmer managerial capacity				Market access			
		Farm area (mz ¹)	Area of pepper in production (mz ¹)	Share of arable land under pepper (%)	Gross household income (US\$·y ⁻¹)	Age of household head (years)	Experience in pepper production (years)	Income from pepper (US\$·mz ⁻¹)	Income from agricultural activities (%)	Price of pepper (US\$·kg ⁻¹)	Rejection rate (%)	
Monopsonic market												
Means	32	14.1 (14.5)	1.43 (1.04)	11.5 (9.4)	7282 (5684)	44.9 (10.0)	5.98 (4.16)	1374.3 (1715.7)	29.3 (30.4)	34.2 (34.9)	0.94 (0.01)	11.6 (0.6)
SD												
Competitive market												
Means	31	38.7 (60.5)	1.16 (0.77)	5.5 (4.7)	7423 (4898)	50.0 (12.0)	7.30 (4.49)	2675.7 (2914.6)	33.1 (27.3)	29.8 (32.9)	0.97 (0.05)	9.6 (4.4)
SD												
t-stat	-	-2.168**	1.088	3.125**	-0.103	-1.834*	-1.187	-2.053**	-0.505	0.488	-2.882**	2.495**

Type of market	Pepper yield (kg·y ⁻¹)	Age of the oldest pepper on the farm (years)	Pepper production			Dummy variables							
			Productivity level (kg·mz ⁻¹ ·y ⁻¹)	Total labour input (h·mz ⁻¹ ·y ⁻¹)	Family labour (%)	Value total inputs (US\$·mz ⁻¹ ·y ⁻¹)	Value total inputs (US\$·kg ⁻¹ ·y ⁻¹)	Secondary education level (%)	Good soil fertility (%)	Problem of drainage access to inputs (%)	Good access to information (%)		
Monopsonic market													
Means	2738.8 (2232.3)	3.31 (3.38)	2101.8 (2112.7)	21.1 (14.2)	84.3 (29.6)	331.4 (393.8)	0.31 (0.42)	52	91	38	44	42	47
SD													
Competitive market													
Means	3127.7 (2640.5)	3.90 (3.56)	3553.1 (3411.7)	40.6 (34.2)	91.9 (18.8)	362.2 (362.2)	0.39 (1.11)	52	74	19	23	58	48
SD													
t-stat	-0.557	-0.652	-1.733*	-2.886**	-1.191	-0.331	-0.362	0.000	4.249	2.540	2.882*	0.838	0.012

¹ mz: Manzana; 1 mz is about 0.7 ha.
t-tests were calculated for continuous variables; chi-square scores were calculated for categorical variables; **, * statistically significant differences at a 5% level and at a 10% level, respectively.

Table IV. Comparison of certain characteristics of farmers who produced pepper in El Roble (Costa Rica) between 2000 and 2008 (SD: standard deviation).

Survey date	N	Age of household head (years)	Farm area (mz ¹)	Area with pepper plants (mz ¹)	Share of arable land under pepper (%)	Pepper yield (kg·y ⁻¹)	Productivity level (kg·mz ⁻¹ ·y ⁻¹)	Price of pepper (US\$·kg ⁻¹)	Rejection rate (%)	Income from pepper production	Income from non-agricultural activities
Data collected in 2000											
Means	1	49.6 (10.8)	52.9 (72.8)	1.32 (0.87)	4.5 (3.6)	3153 (2498)	3186 (2681)	0.98 (0.05)	9.51 (5.43)	33 (26.3)	39 (34.7)
SD	9										
Data collected in 2008											
Means	2	52.4 (13.08)	22.1 (20.1)	1.79 (0.94)	23.6 (31.1)	4530 (3069)	2705 (1493)	0.77 (0.00)	4.76 (1.76)	50 (26.3)	50 (26.3)
SD	4										
t-stat	-	-1.040	-2.523**	-2.014**	-3.762**	-1.628	-0.055	-5.756**	-3.166**	-1.883*	-1.201

¹ mz: Manzana; 1 mz is about 0.7 ha. Mann-Whitney z-scores were calculated; **, * statistically significant differences at a 5% level and at a 10% level, respectively.

farmers between formal and verbal contracts or no contract at all, yet it would be worthwhile to investigate the significance of the farmer's initial endowments and the risk-taking profile of these farmers as influences these decisions. We would expect risk-averse farmers, who are also more credit-constrained, to opt for more secure written contracts. Risk games could shed further light on the causality of this relationship. Secondly, the possibility of breaching contracts and how it occurs in practice deserves further study. Thirdly, the impact of the farm and farmers' characteristics, including the level of diversification, on factor productivity needs further analysis. We found some evidence that productivity levels depend on the farmer's asset base; however, we think it would be worthwhile to expand the production analysis of this paper by analysing the different farming systems, choices in species and other drivers of factor productivity in pepper production. Finally, this paper reports on a revisit to a subsample of the original farmers. It would be worthwhile to extend the survey to all the farmer groups that were involved in the original survey.

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La influencia de los contratos en pequeños productores de pimienta (*Piper nigrum* L.) en Costa Rica bajo diferentes condiciones de mercado

Abstract – Introducción. La producción de pimienta (*Piper nigrum* L.) de Costa Rica es relativamente pequeña, pero representa una interesante fuente de ingresos para los pequeños productores que la producen. En este artículo se analiza si los contratos de producción, entre los procesadores de pimienta y los productores, incentivan a estos últimos a invertir en la producción de pimienta y aumentar sus ingresos a partir de la venta de la misma. Primeramente, se analizan las características de los productores que tienen contratos formales y aquellos que tienen contratos informales, con el fin de determinar si estas características y su elección contractual tienen influencia sobre la forma de producir pimienta, los rendimientos de producción, y por lo tanto el ingreso que generan. En segundo lugar se estudia si las condiciones del mercado de pimienta (uno o más compradores) determinan la elección contractual de los productores. **Material y métodos.** Se aplicó una encuesta en el año 2000 entre 63 productores de pimienta, 32 de los cuales solo tenían acceso a un solo comprador, mientras que 31 podían vender a tres diferentes compradores. Se consultó sobre las características socioeconómicas de cada productor, de la parcela, del sistema de producción de pimienta y se compararon contra las condiciones de mercado y la elección contractual adoptada. Una sub muestra de 24 productores fue revisitada en el año 2008. **Resultados.** En general, los contratos tienen efectos limitados en términos de mejora en el acceso a insumos de producción, e incremento de rendimientos y productividad. Aún así, los contratos parecen ser preferidos por productores restringidos de ingreso, especialmente en las fases iniciales de establecimiento del cultivo y de acceso al mercado. En fases posteriores y bajo condiciones de mercado más competitivas, los productores prefieren tener contratos verbales a contratos formales. In situaciones de monopsonio prevalecieron los bajos rendimientos de producción. **Conclusión.** Los contratos son importantes en las fases iniciales de establecimiento del cultivo, mientras que condiciones de mercado competitivo favorecieron un proceso moderado de intensificación de la producción, el cual produjo altos retornos económicos, a un relativo bajo costo, entre la mayoría de los productores ya establecidos.

Costa Rica / *Piper nigrum* / economía de la producción / oferta y demanda / corrientes de mercadeo / salarios / incentivos