

Market Information and profitability in the cultivation of groundnut (*Arachis hypogaea* L.) in Salvatierra, Guanajuato, Mexico.

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Abstract

The cultivation of groundnut (*Arachis hypogaea* L.) in municipio Salvatierra, Guanajuato, México, represents an important field, but there are limitations of productivity, markets and profit. Based on this, the research aimed at the inquiry of the impact of market information on the profit obtained by the groundnut farmers. The variables analyzed in 2014-2015 were: 1)

Level of markets information; 2) Net Present Value at 12% of annual interest, 3) Internal Rate of Return. Questionnaires were applied at the first meetings, at a start moment of the study and at the end of it to compare the variables. The sample consisted of two layers of 26 producers: one would be Participant of Markets Information sessions (PMI, experimental group) and the other would not be Participant of such sessions (NPMI, control group). Only PMI attended 20 informative sessions about markets. The statistic analysis was made using Kolmogorov-Smirnov test and the t student test was used to compare the data. The results show that the variables were increased significantly ($p \leq 0.05$) for the group PMI, but not for the control group. Hence, it seems plausible to conclude that the increase of markets information affects positively the economic profit of the groundnut producers.

Keywords: Market information. Groundnuts. Agricultural prices

1. Introduction

According to FAO (SHEPHERD, 2001a) a Market Information System (MIS) is a service, usually management by the public sector committed to regular and ongoing collection of information of price and in some cases quantities of widely traded products in assembly markets in rural areas, wholesale or retail markets and timely and regular dissemination through various means of communication to producers, transporters, traders, government officials, economic policy makers and consumers. These systems are designed to increase the transparency of the market and to allow users to make informed decisions related to production and trading. Important part of the behavior of market economy depends on the access to market information, so that the more informed the participants of the process are, the better the market (and the trading process) will work (SHEPHERD, 2001b). The use of information is rather strategic, since knowledge is a source of competitive advantages when applied to the growth of productivity (PORTER, 1999). In fact, lack of information means a major handicap for production and trading.

For years, MIS has been an important topic of study. Today it has evolved into what is known as a second generation of MIS (GALTIER et al., 2014) that takes advantage of advances in technology, and which has allowed a resurgence of this strategy in various parts of the world. With increasing interest in this methodology, it has also become necessary to define adequate ways of measuring the impact of this strategy (STAATZ et al., 2014). One of the possibilities, which is followed in this work, is the analysis of the change in the income of small farmers (SVENSSON AND DROTT, 2010). Many other works have addressed this theme previously. According to Lehecka (2014) and Bastian et al. (2002), market information and market research are major issues for producers who are to commercialize their products,

since the price of primary products in the market can be stable or fluctuating. To know about prices and other relevant topics of marketing reduces the risks when trading the product. This results are supported by Jensen (2010) who states that when small producers manage updated information about the prices of their products, markets work better since that information renders an equilibrium and coordination between sellers at the end of the trading chain and producers, which leads to fair prices and profits to producers and clients. The same way, Amaya and Alwang (2016) state that the flux of information allows producers to move rapidly and efficiently, as the market conditions vary. Complementing the previous ideas Ogutu et al. (2014); Shiferaw et al. (2014) propose that small producers must be provided with market information not just to know the right price of their product but also to be informed about the prices of all the requirements that producers may need along the chain of production. This is significantly important when trying to improve the productivity and profit of the groundnut producers.

It is very important to consider a fair claim of Burrell and Oreglia (2015) who point out that it is necessary to distinguish farmers who have high incomes from the ones who have small incomes, in order to consider the real conditions of each of them to access market information, since not all the agriculturists have the means to access reliable sources of information. To reduce this limitation, strategies must be designed to enhance the radio of information market through the universe of producers. Another aspect that was noticed when doing the previous review of this work and that is associated with the above is the scientific gap that exists in studies of MIS applied to small producers.

Vergara et al. (2005) point out that the use of technology to access information and generate knowledge about the markets represents an important comparative advantage among producers. In fact, it is very clear that being outdated in a market is a major handicap for a producer.

Detre et al. (2011) suggest a very interesting variation about commercializing, proposing that the sale of products should go directly from producers to consumers, because this way producers might offer their product at a higher price (and still the price could be smaller to the consumer than the one offered by middlemen), in order to increase the profit of the cultivation.

In summary, a MIS may be very useful to small producers, since it allows them to: 1) increase their bargaining capacity, 2) reduce costs, 3) move to more profitable cultivation patterns 4) retain products until they find a fair price (SHEPHERD, 2001b), 5) provide social

benefit (KIZITO, 2009), 6) increase their profit and competitiveness (LAM, 2010), 7) detect places where food insecurity might exist (ROBBINS et al., 2006). Nevertheless, a high number of small agricultural producers underestimated the consequences of the lack of information about markets, mainly because of the complete absence of a business culture which provides the right information to enable them to make the right decisions. Market information is essential for groundnut producers and other field producers with similar characteristics to develop market strategies that boost their production (in terms of sales) and their competitiveness, and to evaluate the advantages to see more than one purchaser (middleman). In all, the information provided by MIS intends to help the producer to participate more efficiently to the market.

2. Theoretical approach to profitability analysis.

Profitability is understood as the difference between Total Income and Total Cost of Production (BORJA-BRAVO et al., 2016). Its calculation requires accurate and truthful information in each of these two major sections and, obviously, the profitability can be improved from them. From the scope of the income, with the knowledge of the market that allows to take the decision to sell or not the production as well as to know what is the best time and price that allows to maintain the competitiveness in the market (OSTROSKI AND CONTE, 2015).

Callado (2015, p.163) emphasizes that having information and using it properly marks an important difference for a competitive market in which the maximization of profit, the perception of the environment, privileged and strategic information are important points that must be considered. Measuring the profitability will be necessary to know if the result of the investment is satisfactory for the farmer, since this diagnosis determines whether an investment will be profitable or not.

To calculate profitability, it is necessary to have relevant and up-to-date information. Several studies have shown that the best way to calculate the profitability of any activity is through NPV, IRR and BCR (KUWORNUNU et al., 2013; BRUIN 2011). For its calculation it was necessary to know the NIP of the small producers of groundnuts of both groups in the initial and final moments of the investigation, with and without MIS, but the values of NIP wasn't take like a variable because they don't consider the value of the money along the time. In order to find out the variable Net Present Value (NPV), after a financial run it was clear

that both groups at initial research moment had a very homogeneous behavior when the following items were taken into account: Income determined by the price of sale and the approximate profit in 2015 (to every producer), so as the costs of production along the cycle of production of groundnuts, including the price of the supplies, the preparation of the land to cultivate and labor force (husking, seeding, harvesting and post-harvesting labor).

According to these factors, it was possible to calculate the annual NPV at a rate of 12%, which was, once more, a common feature among the producers. As far as the variable Internal Rate of Return (IRR) regards, it was determined using the same systems of calculations and both indicators were calculated using the formulas contained in the Excel program and verified independently according to the specific mathematical procedure for each indicator and considering the acceptance or rejection criteria established for each one of them. This makes a lot of sense even in the case of annual crops with low depreciation, because they are the most relevant profitability indicators according to financial theory. It is important to mention that if annual IRR is greater than the annual interest rate (acceptable minimum rate of return) used to calculate NPV, which guarantees the profitability of the product.

It is very important to make reference to the fact that a comparison of the NPV of cropping systems over time identifies if these could be more profitable and economically sustainable for farmers compared to current systems (NALLEY et al., 2012). This type of analysis helps identify if incentives will be needed to encourage changes in agricultural practices and, if so, provide an estimate of their magnitude and duration (SGROI et al., 2015).

Despite the advantages of this approach, market information will never be perfect given that one of the factors that most frequently changes is the price of the products - and here the great importance of taking care of this aspect - knowing that the total income is the multiplication of the unit price by the quantity offered in the market (PAZ AND VILLARROEL, 2009); for that reason and according to Lam, (2010) during this work, emphasis was placed on the truthful and constant monitoring of this indicator. According to economic theory, prices are the result of the functioning of markets and are determined by supply and demand, these are the only ones that harmonize conflicting interests of producers and consumers.

According to Alvarado and Cruzado (2003), the most important factor that can influence agricultural profitability is the price of products. A generalized variation of 10 percent in agricultural prices would make profitable - on average - small and medium-sized business producers that operate at a loss; while a generalized increase of 20 percent in prices

would incorporate small commercial and survival producers to the group of producers who make a profit. However, raising prices constitutes an obstacle for consumers; therefore although it is not negligible to improve profitability by increasing yields (quantity offered to the market), this is more complicated than achieving it through price increases (ALVARADO AND CRUZADO, 2003).

Derived from the above, and considering the existence of an inelasticity price of the demand in the market of groundnut; the search for the impacts of market information on the prices of groundnut and, therefore, on profitability, is one of the central aspects of this research.

This research intends to validate the positive effects of MIS on the profitability of groundnut production for smallholder farmers of Salvatierra. In order to verify this, the researches will measure the profits of Participants in Market Information's sessions (PMI) and that of No Participant in Market Information sessions (NPMI) considering the variables related to profit: 1) Level of market information; 2) Net Present Value at 12% of annual interest, 3) Internal Rate of Return and 4) Benefit/Cost Ratio. The selections of variables is related with normal economic variables in the farmers media. Furthermore, this research is an attempt to generate interest in establishing Market Information Systems, whose ultimate goal aims at the improvement of competitiveness and economical profits.

3. Scientific, social and contemporary relevance of the present investigation.

Knowing the great benefits that are attributed to MIS, as well as its scientific gaps, it is important to mention that only a research done with these characteristics has been found. However, this was done with a very small sample that did not turn out to be representative either for purposes of study or extrapolation; with economically different producers; with another type of crop and objectives.

The present research seeks to measure, compare and validate data (with and without MIS) in order to provide this knowledge and fill that scientific gap in a representative manner. In case of these results are favorable, they can be extrapolated to other regions of the country or the world with similar conditions and that currently present great problems to obtain market benefits.

4. Resources and methods

Salvatierra is a municipality belonging to sud of the state of Guanajuato (center of the country). In there live 97,054 habitants, and is a mountain land over 2,000 msnm altitude. To fulfill the objectives of this research, the main communities of groundnut producers from Salvatierra were chosen. The communities chosen were: Cupareo, Maravatío del Encinal, El Sabino, San Miguel Eménguar, La Virgen, Urireo, La Quemada, El Fénix, San Nicolás de los Agustinos, Gervacio Mendoza and El Capulín.

The first task of the researchers was to review articles and other online data about market information, food prices, food demand, income farm and agricultural profitability on sites like: JSTOR, ISI Web of knowledge, CabDirect, Scirus and GoogleScholar.

The previous step of the research was accomplished in order to find out the state of art of the worldwide publications about the influence of information market on agricultural profit. Afterwards, the search was focused on the possibility to measure in economic terms the impact of market information, since literature proposes relation among the variables. In fact, Aldridge (1992) states that the more market information is provided the higher benefit.

Since the topic of the research is relevant and its design is feasible, the researchers started the evaluation of the market system in the chosen region (Salvatierra), trying to have a first insight about the situation of market information there. To accomplish this task, some questions were investigate to find out about the needs of the producers and the markets: What products and varieties should be covered?, Do the type and the quantity of groundnuts produced in the chosen communities fit the requirements of the markets?, how about the consumer preferences? which weight, measure and presentation should the product have?, How often and on which format do producers need to receive market information?, Do producers have access to reliable media of information?, Are producers able to take advantage of the available market information or do they require support to interpret it and use it efficiently? The first question of our field work showed that in the region the preparation for the selling starts when the small producer harvest the product with his family and/or farm laborers. At this point they proceeds to sort the groundnuts according to their quality in order to comply with the quality criteria of the market. This selection is made empirically, according to the size and visible damage of the groundnut, from pests, diseases or mechanical manipulation. After this, the product is packed for shipment and sale.

As a result of the first meetings, the researchers found a group of 52 farmers who accomplished with a minimum characteristics. First, they can be cataloged like “small producers” because his production was for family maintenance, the cultivations was made for tradition, the area are smaller than 2 ha. and the tech are primitive. The second characteristic was all the farmers fill 2 or 3 options between 1) Motion media, 2) Contact with middleman, 3) know about market price, 4) capability for add aggregate value to product, 5) have communication media with others and 6) Tech. In that sense the research in this way, the homogeneity of the sample was ensured. In general, all participants showed sufficiency in topics 2 and 3; And only 12 showed sufficiency in topic 1 in the beginning of the research. Then, the 52 farmers was divide into two group (through a raffle), one group became a PMI and the rest became a NPMI.

Finally, through interviews was established the state of knowledge of the participants with respect to study variables: a) Level of Market Information, b) Net Present Value (NPV) at 12% of annual interest, c) Internal Rate of Return (IRR) and d) Benefits/Cost Ratio (BCR) of the groundnut production, being a) the independent variable; and b), c) and d) the dependent variables.

4.1. Population, sample and information gathering

Obtaining similarities in the information that emerged from the questionnaires, the population was considered homogeneous. This outcome allowed the researchers to divide the producers into two layers: the experimental group who would be Participant of Market Information sessions (PMI), and the control group who would be Not Participant of Market Information sessions (NPMI).

For the PMI group, the methodology of Farmer Field Schools was established, since the experience with them in Mexico (ORTIZ et al., 2016; OROZCO et al., 2013) has been very positive. FFS allow a much more effective type of instruction to farmers than the usual lectures or information delivery.

In more detail, the size of the PMI layer was 26 (n1=26). These participants were inquired about market information, NPV, IRR and BCR, first through questionnaires provided in interviews: one at the beginning, and one and at the end of the study. The design of this research demands the use of random samples, since only by applying a variable in two homogeneous groups or layers, and interpreting the consequences of such variable on both

groups, it is possible to derive, only from the variable, the results proposed through the hypothesis. By this reason, the number of individuals corresponding to NPMI is 26 (n2=26), just like n1. We must remember that at the beginning of the research both layers had homogeneous behaviors, in terms of their relation to the variables (level of market information, NPV and IRR) and also as groups themselves (this is, intra and inter relations, the groups were homogeneous).

At the early stages of the research, 52 interviews (one with every producer) were held during November and December in 2016. Once divided and homogenized the groups, after having a record of PMI and NPMI, the researchers proceeded to increment the variable Level of Market Information, providing market information through 20 training sessions to PMI.

The information provided to PMI was referred to: the price paid by the sellers of the product at “Central de Abastos” (town market) from three big and near locations (Celaya, Querétaro e Iztapalapa) to the groundnut producers, so as the quantities of groundnuts they received from all the producers; the variety, and quality of the groundnuts that were commercialized and, finally, the demands that “Centrales de Abastos” required (Table 1).

Table 1: Market Information Training Sessions

Informative Topics of the Sessions	Number of Sessions to every layer	
	PMI	NPMI
Prices paid to the groundnut producer by Central de abastos de Celaya, Querétaro e Iztapalapa, DF.	10	0
Quantities, varieties, quality, presentation and demand of groundnuts.	10	0
Total	20	0

PMI= Participant in market information sessions.
 NPMI= Not Participant in market information sessions.
 Source: The researchers (2015).

Along 20 training sessions, the PMI were provided with market information, which mainly consisted of FFS session with classes and explanations about the updated prices of supplies and products at different levels of the trading chain, the presentation of the product, months and days in which the products have a higher demand and the different features of “Centrales de Abastos”, so as the information provided by the web site of SNIIM (in Spanish), which corresponds to the English acronym NSIIM (National System of Information and Integration of Markets).

At the final moment of the study (December 2016 and January 2017), by the end of the harvest, 52 questionnaires were applied, one for each participant of the every strata. Measuring the level of market information was possible through theoretical and practical assessment applied in each strata with a 0-100 scale. The level of knowledge of market information was measured (via questionnaire), at the beginning and the end of the research based on what the producers knew about: price information, varieties, quantity and quality supplied and demanded on groundnut markets.

4.2. Statistical treatment

The statistical process was made being the variables: 1) Level of market information, b) NPV, c) IRR, the researchers applied the Shapiro-Wilk test in order to find the probability distribution of the variables at the beginning and at the end of the study.

The Shapiro Wilk test is the most potent non-parametric test of normality in samples smaller than 50 observations (INFANTE AND ZÁRATE, 2001). This statistical treatment, revealed that variables of PMI and NPMI had a normal distribution.

Considering that variables show to have significant normality on the two layers (PMI and NPMI), the *t student* test was used. This test shows the distribution of probability that comes out of the problem of estimating the average of samples of ≤ 30 ; but in spite of this because our sample are homogeneous, the results of the test is valid for small samples and for large ones (SPIEGEL et al., 2009). In fact, according to Infante and Zárate (2001) the *t student* test shows a *normal* appearance, and its approach to normality increases proportionally to the free use of the number of the individuals of the sample. The use of this test is a necessary procedure to figure out if there are significant differences on the variables at the beginning and at the end of the research, this is, if the level of knowledge of market information increases the selling price and the profit of groundnut production of PMI from Salvatierra, in order to compare this results with NPMI and verify the hypothesis of this study.

According to the null hypothesis (Ho), the level of knowledge of market information will not increase the indicators of profit: NPV and IRR. According to the alternative hypothesis (Ha), the level of market information increases the profitability of NPV and IRR.

The null Hypothesis (Ho) and the alternative Hypothesis (Ha) were measured with the *t student* test for both layers, comparing the following variables: NPV, IRR and Level of

Knowledge of Market information.

5. Results and discussion

After collecting the data, the relevant outcomes of these findings will be outlined and interpreted in this section, in order to verify the hypothesis. Finally, the researchers will discuss the results with the findings of other authors, setting the basis for the conclusion of the study.

Table 2: Initial and final values of the variable level of market information, Net Present Value, Internal Rate of Return in Salvatierra (n= 52)

Variables	Layers	Values (average ± S.D.) at the beginning of the research	Values (average ± S.D.) at the end of the research
Level of Market Information	PMI	.41±.05 (a)	.72±.09 (b)
	NPMI	.40±.06 (a)	.40±.06 (a)
Net Present Value	PMI	10,188.34±86.79 (a)	12,605.99±1,943.93 (b)
	NPMI	10,197.70±109.20 (a)	10,239.50±647.68 (a)
Internal Rate Return	PMI	9.82±1.26 (a)	12.96±1.33 (b)
	NPMI	9.70±1.40 (a)	9.73±1.47 (a)
Benefit/Cost ratio	PMI	0.842±0.014 (a)	0.933±0.016 (b)
	NPMI	0.853±0.012 (a)	0.848±0.014 (a)

PMI= Participant in market information sessions.

NPMI= Not Participant in market information sessions.

Source: The researchers (2015).

The use of the same letters indicates that there is no significant difference ($p > 0.05$); and the use of different letters indicate significant difference ($p \leq 0.05$). The level of market information is expressed on a 0-1 scale. The NPV is expressed on \$/hectare based on an annual rate of interest of 12%. The Internal Rate of Return is expressed on %. PMI= participants who were provided with market information. NPMI= Participants of the research who were not provided with market information. The Benefit/Cost ratio support S.D.= Standard Deviation.

As the table shows, the initial values do not show significative differences ($p > 0.05$) between the two layers, as far as the behavior of the studied variables regards. This is the natural consequence of the homogeneity of the groups that made up the layers at the beginning of the research.

Taking into account the homogeneity of the initial sample and the work of the informative sessions provided to the Participants Provided with Market Information (PMI), in contrast to no sessions provided to Participants not provided with Market Information (NPMI) and considering also that the influence of other external variables is inexistent, or at least not perceptible, it is possible to think that the changes in PMI could be the consequence of the changes in the variables know, as the hypothesis states.

As far as the Net Present Value regards, there are significant differences ($p \leq 0.05$) between PMI (experimental group) and NPMI (control group) at the end of the research, this is, after the briefings took place. The same results are referred to the Internal Rate of Return, and is evidenced also in the benefit-cost ratio, as shown in the table.

Hence, there are not reasons to believe that the results are to be attributed to other factors or variables than the market information provided to small producer of groundnuts of Salvatierra. It is very noteworthy the fact that the highest value reached by the variables was the level of (knowledge of) market information: the main variable that seems to have led the behavior of the others. Reliable market information provided along the groundnuts producing process and its commercialization, affected in a positive way the profit that small producers received from their groundnut crop of January 2017. We think what this information gave the producers the opportunity to have a wider scope of the market and to make informed decisions to sell the product at a better price, going to the right place (purchaser) at the right moment, because the training sessions was the unique different activity between PMI and NPMI, and between PMI after and before the research.

These results show to be coincidental with the outcomes described by Courtois and Subervie, (2014), Orozco et al. (2013), and is a strong evidence of the benefits of PMI for small farmers in rural Mexico. Also Svensson and Drott (2010) are some point in accordance with this work, So it can be said that the results reinforce other research works of the area. On the other hand, there are authors (OGUTU et al., 2014; BURRELL AND OREGLIA, 2015) who differ from the techniques and the results achieved, which suggests that it is necessary to go even further in this type of work to validate, and that it can not be said that there is absolute certainty about a particular strategy.

6. Conclusions

The results obtained allow to conclude that the producers who were provided with market information (PMI) increased their level of knowledge of market information and had a significant uprising of their profit, measured statistically through the NPV and IRR at the end of the research. In contrast to this, the producers who were not provided with market information (NPMI), or control group, did not increase significantly their level of knowledge of market information, and consequently did not make possible an uprising of the variables NPV and IRR, which did not change significantly in comparison to the behavior of the same variables in 2015.

It is important to outline that the increase of profit is due to the change in the information of the main variable of this research (level of market information), since the profits did not depend from external variables. Variables like: gender and age of the producers, cultivated area, productive infrastructure of the markets, governmental support, credits and incomes derived from other activities were not taken into account for the analysis since they were not significant, because the sample had very similar conditions about the mentioned features, meaning that the sample (of producers) was initially homogeneous.

This proves that market information really improved the profit of the groundnut producers of Salvatierra. In fact, market information is a key factor for commercializing the product. Information about prices would be more useful if it was offered along with varieties of groundnuts, quantities and forms of presentation of their product in every negotiation, depending on the place and time of the negotiation of the product. Furthermore, it would be great help to inform about the supplies and optimized technology required along the chain of production of groundnuts.

All this attempts to create sustainable development of the producers. This is a first step, and of course, this information should enable the producers to create solid ideas which render their projects interesting to investors (banks) which could provide credits, etc.

It is necessary to continue research on the field of market information. On this effort, it is required the cooperation of academic and private/governmental institutions. The trading improvements of producers of groundnuts are not to be underestimated: It is very relevant to study the possibilities that allow groundnut producers to place their product on international markets. But to create a new culture of production, a long way of experiments and changes must be undergone, and this requires a lot of assessment, study and investment to make more efficient every link of the chain of production.

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