Investigation note

Economic indicators in the use of corn seed of normal and protein quality (QPM) in Veracruz

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Abstract

Corn is one of the most outstanding crops of the Mexican Republic, because it is an important part of the Mexican diet, as well as having a strong social and cultural connotation in the country; however, the yields of this cereal are low due to the fact that, among other factors, the use of improved seed is scarce in the state of Veracruz. It has been estimated that the use of improved seed is 22% with an average yield of 2.2 t ha^{-1}. This paper analyzes the impact of productivity and estimates maximum prices of corn seed that farmers would be willing to pay for corn hybrids that were evaluated in the localities of Tlachiconal and Experimental field Cotaxtla in the state of Veracruz under seasonal conditions, during the spring summer 2010 cycle. The genotypes used were: H-520, H-564C, H-561, H-565, H-518, HEA1-17, (LPSC7F64-2-6-2-2-BBB/CML495)CML494, (CLG2312/CML495)CML494, (CML269/CML264)CML494. Based on the economic indicators analyzed in this paper, it was concluded that the use of certified seed could increase as long as the maize materials being evaluated present high yields and even though the cost of the seed would be very high. high, these would be justified and preferred by high productivity rates of new maize materials, which would respond to the expectations of corn producers.

Keywords: economic estimation, prices, productivity.

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Introduction

Corn is a key crop for Mexico, each year approximately 8 million hectares are sown, in 2014 the grain harvest was around 23 million tons with an average yield of 3.3 t ha^{-1} SIAP (2016), the crop of corn in the country is in charge of more than two million small-scale producers where the smallholding predominates and the intensive use of family labor, it is estimated that more than half of the national corn production comes from this system that it is also known as subsistence and traditional agriculture (Sánchez *et al*., 2000; Mera, 2009; Turrent *et al*., 2012).

Despite this, in Mexico and Central America, the use of improved seeds is very low, with the exception of El Salvador where the use of hybrid seed exceeds 50% of the total area planted (Espinosa *et al*., 2003a). In the rainfed areas of Mexico, the demand for seed improvement is heterogeneous and the result of the adoption is uncertain, in the state of Veracruz the low yields are due, in part, to the scarce use of improved seeds, only 22% of the surface is sown with certified seed of varieties and hybrids (Sierra *et al*., 2005).

Deepening to this reality studies published in Mexico, have documented that in the country malnutrition is a public health problem and is among the first five causes of infant mortality, in the country there are approximately 31 million people with malnutrition, concentrated in 10 millions of indigenous people and low-income population in the cities (Espinosa *et al*., 2003b; Sierra *et al*., 2010; Sierra *et al*., 2011).

Under this scenario, quality protein Maize (QPM), is an alternative to reduce malnutrition and low production of corn, these are characterized by having the same total amount of protein and twice as many amino acids essential in relation to corn of normal quality (Espinosa *et al*., 2003b).

The objective of this study was to estimate the maximum seed prices that farmers would be willing to pay for hybrid maize seed of normal quality and protein quality related to the productivity levels, that these materials presented in the evaluations of Tlachiconal and Cotaxtla, state of Veracruz.

Methodology

The information used corresponds to data provided by the Cotaxtla Experimental Field-National Institute of Forestry, Agriculture and Livestock Research (INIFAP) and is the result of the evaluation of yields of corn hybrids of normal quality and of high protein quality evaluated in conditions of during the Spring-Summer cycle in 2010, the validation modules were located in the towns of Cotaxtla Field, located in the Municipality of Medellin of Bravo, and The Bajos de Tlachiconal, Cotaxtla, Veracruz. The germplasm used in the validation lots included commercial hybrids: H-520, H-565, H-561, H-564C, H-518, three white grain experimental hybrids (LPSC7F64-2-6-2-2-BBB/CML495)∗CML494, (CLG2312/CML495)∗CML494 y (CML269/CML264)∗CML494, and the yellow grain experimental hybrid HEA1-17.

The economic analysis was based on a modification to the standard formula for the marginal analysis of two technologies proposed by the (CIMMYT, 1988).

The original formula is:

$$AR = ATCV * (1 + M)/P \quad 1)$$

AR= additional performance needed to change from a T_0 (current corn variety) technology to a T_1 technology (alternative variety); ATCV= difference between the total of the varying costs (TCV) of the two technologies; M= minimum necessary return required by the farmer to go from T_0 to T_1 and P corn market price.

However, in this work we considered the modification to the standard formula, made by Espinosa *et al*. (2003b), which allows us to compare two alternative varieties of corn and estimate the maximum price that farmers could pay for a new technology (seed), which is described below:

$$AR = (R_1-R_0) = [(P_{s1}-P_{s0}) * S * (1+M)]/P \quad 2)$$

Where: AR= additional performance needed to change from a T_0 technology to a T_1 technology; R_1= average yield of the variety in T_1 (QPM); R_0= average yield of the variety at T_0 (normal quality); P_{s1} = seed price in T_1 (QPM); P_{s0}= seed price in T_0 and S= amount of seed used per unit area.

$$Ps_1=[(R_1-R_0) * P]/[(1+M) * S] + Ps_0 \quad 3)$$

The value of M, is generally a subjective estimate, it has been estimated that for small-scale farmers in developed countries, the value of M should not be less than 100% (CIMMYT, 1988).

Results

In Table 1, the results of applying equation (3) are presented, using prices of corn seed and grain prevalent in the country, assuming that the average yield of the farmer variety. R_0= 2 200 kg ha^{-1}; R_1= 2 310 kg ha^{-1}; P= 5.50 $ kg^{-1}; S= 25 kg ha^{-1}; M= 100% and using the value assigned to the seed used by the farmer that is an average value of the seed of various corn hybrids that are subsidized (50% of the real value) by the town hall of the Municipality of Tierra Blanca, Veracruz, in 2015; that is, P_{s0}= 29.00 $ kg^{-1}. Thus, for example, with a yield advantage of the new variety of only 5%, a farmer would be willing to pay a maximum of 41.10 $ kg^{-1} for the new variety, a seed-grain price ratio of 7.47.

This relationship allows determining that the farmer is willing to pay much higher prices for the new improved seed. This offers a possible explanation of why farmers who use improved seed and produce high yields with their current varieties are more willing to change their seed if there is another one that is only modestly superior in yields and pay relatively high prices for new seed. (Espinosa *et al*., 2003 b). On the other hand, considering a yield advantage of 10% of a new variety on one that produces 6.2 t ha^{-1} farmers would be willing to pay up to 97.2 $ kg^{-1} of the new variety, which means a seed-grain price ratio of 17.67.

In this context, and as we move to the upper left corner of Table 1, we are referring to small-scale farmers with low yields and very sensitive to the prices of improved seeds, whereas, if located in the lower right corner of the picture, the opposite happens; that is, they are large-scale farmers who prefer improved high-yield seed and are therefore less sensitive to seed prices.

Table 1. Economic analysis of a new variety of maize vs. improved variety used by the farmer, for different yield levels of the farmer's improved variety (R_0) and the new variety (R_1).

Percentage of performance of the new variety (R_1), about the variety of the farmer (R_0)	Yield of the farmer variety R_0 (kg ha^{-1})				
	2.2	3.2	4.2	5.2	6.2
	Maximum price to pay for new seed PS1 ($/kg)				
5	41.10	46.60	52.10	57.60	63.10
10	53.20	64.20	75.20	86.20	97.20
15	65.30	81.80	98.30	114.80	131.30
20	77.40	99.40	121.40	143.40	165.40
25	89.50	117.00	144.50	172.00	199.50
30	101.60	134.60	167.60	200.60	233.60
	Seed price ratio:maximum grain acceptable (P_{s1}/P)				
5	7.47	8.47	9.47	10.47	11.47
10	9.67	11.67	13.67	15.67	17.67
15	11.87	14.87	17.87	20.87	23.87
20	14.07	18.07	22.07	26.07	30.07
25	16.27	21.27	26.27	31.27	36.27
30	18.47	24.47	30.47	36.47	42.47

In the Table 2 shows the average grain yield of corn hybrids evaluated in the localities of Tlachiconal and Cotaxtla in the spring-summer cycle in 2010, it was observed that the experimental hybrid (CLG2312/CML495) ∗ CML494 produced 6 840 kg ha^{-1} and exceeded in 1 560 kg ha^{-1} (30%) the H-520 which is the control hybrid that is most frequently occupied in the study area (Sierra *et al*., 2005; Sierra *et al*., 2011).

The results obtained after applying equation (3) determined that corn producers who used seed of H-520 could have invested up to a maximum of 177.10 $ kg^{-1} of experimental hybrid seed (CLG2312/CML495) ∗ CML494, which results very high by the difference in the productivity of these materials; however, from an economic point of view, Veracruz farmers are willing to pay very high prices for improved seed, as long as the new corn materials are really attractive in terms of average yields, which could increase the competitiveness of the farmers corn producers in Mexico.

Table 2. Average yield in t ha^{-1} of corn hybrids in the localities of Tlachiconal and Cotaxtla, Veracruz.

Hybrids	Average yield (kg ha^{-1})	percentage respect the control	Maximum price a pay for kg of seed
(CLG2312/CML495) ∗ CML494	6 840	30	177.10
H-565	6 430	22	132.00
HEA1-17	6 230	18	110.00
H-561	6 230	18	110.00
(CML269/CML264) ∗ CML494	6 210	13	107.80
(LPSC7F64-2-6-2-2-BBB/CML495) ∗ CML494	5 990	7	83.60
H-518	5 670	7	48.40
H-564C	5 470	4	26.40
H-520	5 280	100	-

The price that producers of corn of the listed materials is estimated, assuming that they produce corn currently with the hybrid H-520. The values of equation (3) used for the calculation are: P= 5.50 $ kg^{-1}; M= 100%; S= 25 kg ha^{-1}; P_{s0}= 5.50 $ kg^{-1}.

Conclusions

Based on the economic indicators that have been analyzed in this paper, it is concluded that the use of certified seed could increase as long as the maize materials being evaluated present high yields, although the cost of the seed would be high, these would be justified and preferred by high productivity indexes of the new maize materials, which would respond to the expectations of corn producers.

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