

Characterization of seasonal corn producers in Tierra Blanca, Veracruz

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Abstract

Maize is one of the main crops in Mexico due to the fact that it plays an important role in the diet of the Mexican, the main source of supply of this grain in the national market comes from around 2.6 million small producers who grow this cereal in areas smaller than five hectares and also represents one of the fundamental pillars for the food security of rural families who are generally in conditions of marginalization and poverty. The objective of this article is to characterize seasonal maize producers in 14 localities of the Municipality of Tierra Blanca, Veracruz state, which have high and medium marginalization rates. In this sense and to understand the productive management processes of the farmers, this research was carried out to understand the economic, social and productive aspects associated with maize yields under rainy season conditions in the spring - summer 2015 cycle, with the design of a questionnaire, information was collected through personalized interviews with the producers. The results showed that the producers have an average of 55 years of age with 5.5 years of schooling, each family has about 4 members, the average size of the plots is 11.28 hectares/producer, 94.3% uses improved seed and achieve a yield average of 2.8 t ha⁻¹ with an average density of 31 948 plants ha⁻¹. The main animals that were found in the lots or backyards were: chickens, pigs, bovines.

Keywords: marginalization, poverty, yields.

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Introduction

In Mexico, the agricultural sector is a fundamental pillar in the economy and development of the country. The importance lies in the functions it performs such as food security, the conservation of the environment, the rural landscape and the contribution to the viability of rural areas by favoring a more balanced territorial development (Ayala and García, 2009; Creciente, 2002). In 1994, the North American Free Trade Agreement (NAFTA) was signed; however, in this way, the state's agroindustries were liquidated, the installed capacity for the production and distribution of fertilizers and seeds, the agricultural extension service, the regulation of prices, the control of imports and practically the development bank. For the field, the adjustment included the dismantling of instruments, institutions and resources designed for the inclusion of family production and a clear change of interlocution that probably had its clearest manifestation in the classification in 1988 of business producers with productive potential and the rest that were disengaged from productive policies to allocate them to the non-productive subsidy regime through direct transfers (Chapela *et al.*, 2014).

Agro-businesses and large export-oriented corporations to the United States dominate the rural landscape of Mexico and are determining factors in public policies that favor them in the face of family agriculture (Palacio and Cavalotti, 2013). The difference between corn producers in Mexico and the United States of America is abysmal: the size of the farms is 21 times larger in the United States of America, direct subsidies are 18 times higher and yields almost quadruple the Mexicans Robles (2013), NAFTA has become a strategic axis to force the modernization of the agricultural sector, producers who met the immediate conditions to raise productivity, reduce costs and sell at competitive prices have been the beneficiaries of this structural change, around 5% of the total, the producers that have not been able to do so correspond to 95% of the total, are condemned to the displacement of the market, their production to be replaced by food imports and raw materials from their commercial partners (Salinas, 2004).

On the other hand, the neoliberal model has increased the levels of poverty and marginalization of large sectors of the population, this model uses massive and growing food imports, putting the sovereignty and food security of the country at risk due to the low production levels of the country. most of the farmers in the field and their families, as well as the increase in poverty, hunger and malnutrition in the majority of the population, especially those living in rural regions (Rubio, 2001), in this sense the development local is a strategy designed to improve the standard of living of specific population groups, is located in the broad dimension of a process of social transformation that requires the rethinking of relationships with nature (Orozco *et al.*, 2007).

Therefore, the knowledge of the communities and social actors is of vital importance to understand the dynamics of the relationship between the population and their economic, social, cultural, political and environmental environment, as well as to enhance their possibilities to appropriate their development process (Salas, 1994), under this scenario the diversification of activities of small farmers and peasants constitutes a survival strategy that is developed through the combination of activities (agricultural and non-agricultural) that can be developed inside or outside the production units (in or out of the community where producer is located (Sacco *et al.*, 2007). In this sense, producers seek more efficient alternatives for their production systems or change their

crops for others that may offer them greater profitability; in the case of traditional farmers and most of the country, the solution is not in changing the crops, but in making viable their production system due to other factors that have a culture and economy based on corn (Calva, 1991).

In this context, Mexican agriculture is characterized by developing under a bimodal system in which peasant and business production units coexist (Schejtman, 1981), where the size of the plot has become an indicator of the type of production unit and the distribution of income in the field, thus about 3 million producers grow basic grains in Mexico in an area of more than 14.2 million hectares, almost one million of them cultivate plots no larger than one hectare and only absorb 7.8% of the surface, 53% work plots with extensions between one and five hectares, in 39% only 472 thousand producers exploit larger units and absorb more than 53.5% of the working surface (De Ita, 2003).

The corn in Mexico, is produced in two agricultural cycles: spring-summer and autumn-winter under various conditions of climate and humidity (seasonal and irrigation), the production of corn under seasonal conditions is one of the main activities of the rural sector (Maya *et al.*, 2010). At the national level, it is sown in more than eight million hectares, of which 2.5 million correspond to the tropical region, 17.57% of the national surface is cultivated under irrigation conditions and 82.43% is cultivated under temporary conditions (SIAP, 2014), in charge mainly of more than 2 million small-scale producers who plant it mainly for self-consumption, more than half of the national production of corn comes from this system, which is also known as subsistence because it contributes significantly to the safety of the poorest rural strata (Sánchez *et al.*, 2000; Mera, 2009; Turrent *et al.*, 2012).

In the state of Veracruz, the area sown with corn is just over 566 thousand hectares with an average yield of 2.2 t ha⁻¹ (SIAP, 2014). In this state an average of 200 thousand producers are dedicated to the cultivation; the majority sow from 1 to 3 hectares and are located mainly in marginalized regions and with medium or low productive potential, whose production destination is basically self-consumption (INEGI, 2007), the state of Veracruz has a high social lag index, 59 % of the population lives in poverty, in the municipality of Tierra Blanca there are 93 397 inhabitants, of which: 20.1% suffer from food poverty, 30% poverty of skills and 59.2% poverty of heritage; likewise, 84.68% of the population surveyed in this study has a high marginalization index, that is, there are no opportunities for development and no capacity to find them, the rest of the population has low marginalization indices (CONEVAL, 2014).

In the municipality of Tierra Blanca there are a total of 555 hectares dedicated to the cultivation of corn, of which 285 ha; that is, 51.35% are cultivated under temporary conditions with an average yield of 3.82 t ha⁻¹ (SIAP, 2014). Under this aspect and considering that the cultivation of corn is the central axis of food security especially of small producers who generally live in conditions of marginalization, poverty and inequality of opportunities, this article aims to determine the socioeconomic characteristics and estimate the yields of temporary maize in 14 localities of the Municipality of Tierra Blanca of the state of Veracruz by means of the evaluation of the productivity levels of corn hybrids of normal quality and of high protein quality to identify the maximum seed prices that the farmers would be willing to pay.

Materials and methods

The research was conducted in Tierra Blanca, a municipality located in the Veracruz coastal plain of 8.54983° 27' north latitude and - 96.28645° 21' west longitude, has a total of 94 087 inhabitants and 26 691 homes, the municipality is made up of 325 localities; nevertheless, the study covered only 14 localities that are characterized by high and medium marginalization indices (CONEVAL, 2014).

The information was collected through personal interviews through previously structured surveys that included social, economic and productive questions related to the cultivation of corn, the sample size considered a universe of 520 producers who received support from PROCAMPO with corn seed of improved varieties CP 569 and hybrids Biogene and Dekalb in 2015, the simplified formula was used for simple random sampling for proportion estimation but with the maximum variance condition (Taro and Cochran, 1977), as well a sample size of 81 producers was obtained where the yield estimation was performed, the data obtained at the plot level were calculated by means of the correlation analysis of the variables: plant density and average corn yield ($t\ ha^{-1}$), this information it was corroborated by regression analysis to obtain the highest precision and accuracy of the results.

To understand the economic and social aspects associated with maize yields, a questionnaire was applied to 70 of the 81 farmers in the yield estimation, this difference in the number of producers surveyed is mainly due to the fact that the informants could not be located the days that were planned for the survey of the information, for which, the value of the accuracy was recalculated obtaining a value of 0.12.

Results and discussion

Social component

The average age of the heads of family surveyed is 55 years, with 5.5 years of schooling, 25.7% of the interviewees acknowledged not having any school year, 78.6% of the producers know how to read and write, 27.2% attended at least four years of study, 31.4% completed primary school and others (15.7%) presented between 9 and 12 years of schooling (Figure 1).

In this respect, Alvarez *et al.* (1985), mention that the level of schooling is associated with a greater use of technology and that increasing schooling increases the income. The average number of members of the families is five, 50% of the households have between one and four members and the other 50% have between five and eight. All the interviewees are engaged in agriculture, however in the case of women (30%) they also did housework and raising animals; 2.9% is also a student and 2.8% guaranteed to do extra work on the farm as a day laborer or employee with payments ranging from \$150.00 to \$200.00 a day. The execution of agricultural and non-agricultural activities has always been a basic survival strategy for peasant families (De Grammont, 2009).

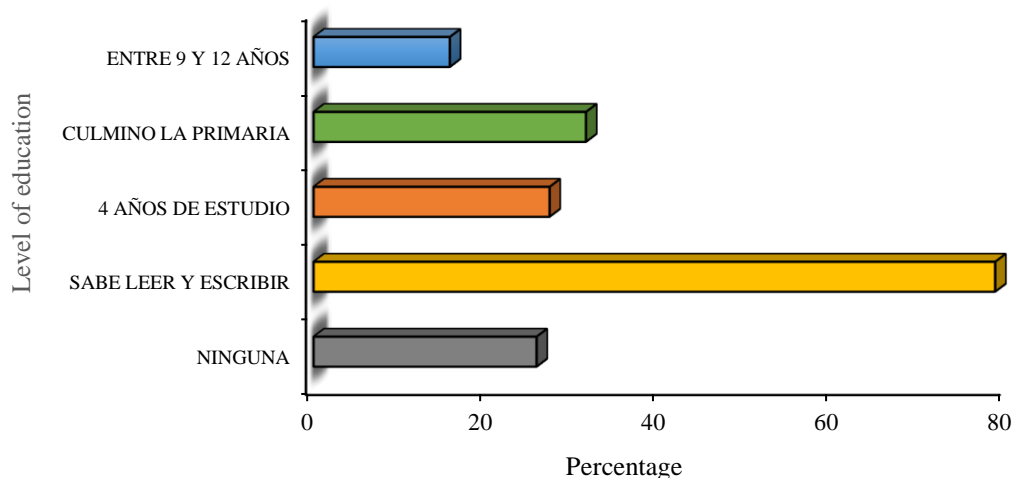


Figure 1. Level of education as a social component in the municipality of Tierra Blanca, Veracruz.

Agricultural component

The average surface of the properties that the interviewees possess was 11.28 ha, the minimum of 1 and the maximum of 12 hectares destined to different productive activities, of which 2.5 ha are for the cultivation of corn, 94.3% of the producers mentioned to be owners of these lands; however, 4.3% indicated that they lend their properties and 1.4% give them in rent. The usufruct of the land is: 90% ejidal and 10% small property, with respect to the humidity regime, 94.2% of the producers carry out temporary agriculture and the rest have some irrigation system. In the state of Veracruz, they are engaged in the cultivation of maize in an average of 200 thousand producers, most of them sowing from 1 to 3 hectares, located mainly in marginal regions and with medium or low productive potential and whose destination of production is basically self-consumption (Palafox *et al.*, 2013).

The 85.7% of the respondents said that the maize storms are made in the months of June July when the rainy season begins, the use of improved seed in the municipality is 94.3% and the rest corresponds to the use of creole materials 90% of the seed used by respondents comes from the City Council through the Municipal Rural Development Secretariat of Tierra Blanca, which is offered to producers through economic subsidies, i.e. the city subsidizes 50% of the real price of the seed, the other 50% is paid by the farmer, the sowing method that presented the highest frequency of use in the study area is the speck, as represented by 71.7% of the interviewees.

Corn production technology

In Mexico, around 8 million hectares are planted each year, of which 2.5 million correspond to the tropical region. In the state of Veracruz, the area sown is 530 thousand hectares with an average yield of 2 t ha⁻¹. The sowing is distributed in two agricultural cycles, 380 thousand hectares in rainy or spring-summer and 150 thousand of residual moisture (Tapachole) and irrigation that develop during the autumn-winter cycle (Palafox *et al.*, 2013). In the localities where the research was conducted, the results showed that in 2015 the area cultivated with corn was 197 hectares, of which 177 hectares were cultivated for grain and 20 hectares for fodder.

The agronomic management of the crop includes practices of: soil preparation, date of sowing, cultural work, density of sowing, application of fertilizers and pesticides, among others that the producer carries out during the crop cycle and the way in which they are combined the factors of production in each of the practices (Palafox *et al.*, 2013), in this sense 75.7% of the respondents made the passage of a harrow, 74.3% of the producers applied at least one herbicide prior to sowing, and the furrow was performed by 58.6% of the population under study. With regard to cultural work or crop maintenance, 97.14% of the producers made at least one fertilization and 58.6% of the interviewees applied some insecticide to control crop pests. The main fertilizer used by producers is urea, 87.1% of respondents reported, followed by ammonium sulfate with 17.1% and diammonium phosphate-DAP with 11.4% in the study area, Table 1 shows the number of producers and the type of fertilizers they use in the seasonal corn crop cycle.

Table 1. Number of producers and fertilizers applied in the cultivation of rainfed maize in Tierra Blanca.

Fertilizer	Number of producers			
	Yes	(%)	No	(%)
Urea	61	87.1	9	12.9
Ammonium sulphate	12	17.1	58	82.9
DAP	8	11.4	62	88.6
Triple 17	11	15.7	59	84.3
Triple 16	3	4.3	67	95.7
Organic	3	4.3	67	95.7
Foliar	2	2.9	68	97.1
21-10-20	1	1.4	69	98.6

Source: data obtained from the survey carried out in the field.

On the other hand, the results of the estimation of maize yields of rainfed in the study area were 2.8 t ha⁻¹ with an average population density of 31 948 plants ha⁻¹, in this respect the town that obtained the highest yields was the locality of “Nuevo Arroyo Tambor” with 4.13 t ha⁻¹ with an average density of 49 395 plants ha⁻¹ (Table 2).

One of the factors related to the low production of corn is the density of plants, Tinoco *et al.* (2002), indicates that for improved varieties of low and intermediate size should be used about 62 500 plants. The population density is considered as the most important controllable factor to obtain higher yields in crops.

Planting density in maize exerts a high influence on grain yield and agronomic characteristics, since grain yield increases with population density until it reaches a maximum point and decreases when density increases beyond this point. Sangoi (2000), indicates that population density is one of the factors that often changes the producer to increase grain yield, however if

population densities are used greater than the optimum increases the competition for light, water and nutrients, causing reduction in root volume, number of ears, amount and quality of the grain per plant and increase the frequency of root and stem rots, which favors low population densities cause problems with weeds or waste of soil (Maya and Ramírez, 2002; Njoka *et al.*, 2005).

Table 2. Density of plants and average yields t ha⁻¹ of seasonal maize in 14 localities of the Municipality of Tierra Blanca.

Location	Average density (plants ha ⁻¹)	Average yield (t ha ⁻¹)
Arroyo Tambor	49 395	4.13
The Tuna	41 060	2.6
Loma Caballo	39 811	3.90
Campana	39 128	3
Cazadero	35 894	2.98
The Jicaro	35 295	1.99
Conchas	33 711	3.67
San Nicolas	33 100	2.54
Paso Magueyito	30 948	3.54
Mata Maguey	27 824	2.96
San Francisco	27 808	2.79
The prietas	24 034	1.96
Plan of Villa	23 445	2.02
Lazaro Cardenas	23 178	2.8
Nueva Reforma	14 583	1.26

Source: data obtained from the survey carried out in the field.

The correlation analysis (Figure 2) of the variables plant density and average yield t ha⁻¹ indicated that there is a positive correlation ($r= 0.98$; $p= 0.01$), while the regression analysis showed a linear trend ($R^2= 0.96$; $Y= 0.0677x + 0.482$); however, the relationship between grain production and population density is complex, since the best response in grain yield varies according to the condition of soil, climate, cultural practices and genotype (Pinter *et al.*, 1994; Sangoi, 2000), work done on population densities in maize hybrids under temporary in the humid tropics showed that increasing the density from 50 000 to 62 500 plants ha⁻¹ obtained the highest grain yield since the yield increased by 0.30 t ha⁻¹ (Cano *et al.*, 2001). On the other hand, Carrera and Cervantes (2006) reported that the yield increased 0.6 t ha⁻¹ by increasing the population density from 60 000 to 70 000 plants ha⁻¹.

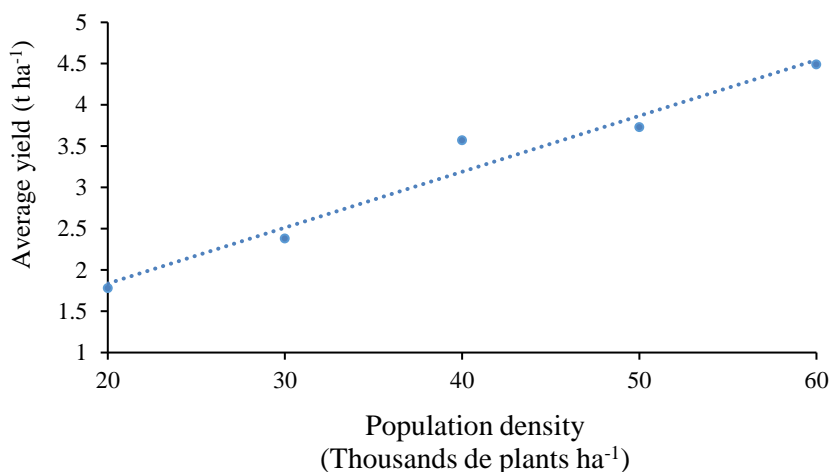


Figure 2. Effect of population density on average yield t ha⁻¹ of seasonal maize in the municipality of Tierra Blanca.

Production, consumption and sale of grain

Corn is a key crop for Mexico, in the period 2016-2017 the consumption of corn grain in the country was approximately 38.7 million tons of which 23.3 million tons corresponds to white corn and 15.3 million tons is yellow corn (FIRA, 2016), the producers related to the research, stated that of the total production of grain they obtain, they reserve an average of 1 800 kg ha⁻¹ for family self-consumption but the producers affirmed that on average they buy 690 kg of maize for human and animal consumption generally in the months of September and October, 34% of respondents produce corn solely for self-consumption, while 66% of producers sell corn in the town or in the municipal seat, 85% of these said that the grain of corn they buy has lower quality compared to the one they produce and sell, however, the corn was sold at an average of \$3.50 kg, and they bought it at \$5.00 kg; that is, the product is losing on average \$1.5 kg of purchased corn.

Livestock component

The raising of animals in rural areas and mainly of small producers constitutes a survival strategy that is related to agricultural activities and that together are aimed at the food sovereignty of producers, the result of the surveys showed that producers have total 2 022 animals, including birds (chickens), cattle (cows, bulls, calves), sheep and pigs, being Lazaro Cardenas the town that has the largest number of hens with a total of 259 birds/town, Villa Plan presented 103 heads of cattle/locality, Loma Caballo a total of 36 porcines/locality and The Prietas reached 29 sheep/locality. In Figure 2, it presents in summary the type and number of animals by location.

Castañón (2009) assures that the backyard livestock is a system characterized by the raising of a group of animals such as birds, horses, cattle, pigs, goats, sheep and cattle, the importance of livestock for peasant families lies mainly in that the products obtained can be used for self-consumption, and in case of economic necessity, they are used for sale, partially ensuring the

survival of the family (Gutiérrez, 2007). Raising pigs (*Sus scrofa* ssp.) generates income from their sale on foot, most of them are fed with waste or kitchen and harvest leftovers. Likewise, sheep (sheep) (*Ovis aries*), goats (*Capra hircus*), hens (*Gallus gallus*) and turkeys (*Meleagris gallopavo*) are part of the diet of the producers, they are the main food at parties, which have a great importance in these communities, given that it is through this type of events that the peasant family as a social unit maintains and consolidates networks and relations with other farmers (López *et al.*, 2012).

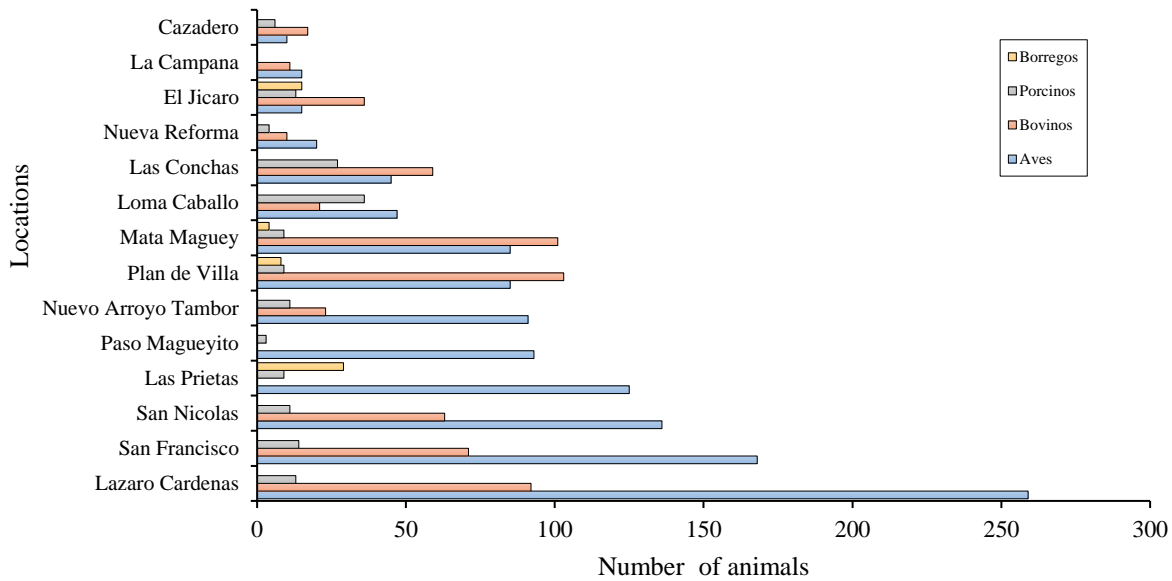


Figure 3. Number of animals by location in the Municipality of Tierra Blanca, Veracruz.

Under these considerations, it was determined that the raising of the animals of the producers of Tierra Blanca constitutes a strategy that provides food for self-consumption in addition to becoming a means to solve some type of need, in this sense 84.3% of the producers raise chickens with an average of 17 birds/producer, 96.6% of these animals are reared under backyard or solar conditions, likewise, the surveys showed that 61.4% of the people who participated in this research have an average of 6 cows/producer, 58.6% of cattle are reared in paddocks adjacent to the site, pigs (47.1%) are reared in lots or backyards, 58.6% of producers have an average of three animals. In the Table 3 shows the type of livestock and the frequency of producers who are also engaged in the cultivation of corn to raise animals.

On the other hand, 52.6% of the producers said that when corn production has good yields this helps to solve animal problems such as feeding, investment and disease control because they manage to satisfy the nutritional needs of the animals, In addition, there is availability of capital to make investments to improve the breeding of their animals as well as to control diseases, 31.6% indicated that these problems can be aggravated when there is no good production of corn and 15.8% said there is no relation between the yield of corn and the problems of the animals.

Table 3. Type of livestock and number of producers dedicated to raising animals, in the Municipality of Tierra Blanca, Veracruz.

Animals	Yes		No	
	Frequency	(%)	Frequency	(%)
Birds	59	84.3	11	17.7
Cows	43	61.4	27	38.6
Pigs	41	58.6	29	41.4
Calves	36	51.4	34	48.6
Bulls	22	31.4	48	68.6
Sheep	5	7.1	65	92.9

Source: data obtained from the survey carried out in the field.

Conclusions

The main productive activity in the localities evaluated in the state of Veracruz is self-subsistence agriculture, with maize cultivation being the most important with an average of 2.5 ha of cultivated area, with an average yield estimate of 2.8 t ha⁻¹ and an average population density of 31 948 plants ha⁻¹. The producers of the localities that are the product of the present investigation are willing to implement certified corn seeds provided there are guarantees that allow them to obtain higher yields.

The raising of backyard animals such as cows, pigs and chickens, is a strategy that allows the families surveyed to regenerate alternative means of self-consumption and income generation, especially among women. Land tenure in most producers is ejidal, crops are grown under rainfed conditions, water is the most limiting factor for production, plantings are made at the beginning of the rainy season in the months from June and July.

The use of improved seeds (hybrids) predominates in the area, the same ones that have been evidenced in the present investigation that do not adapt in the best way to the area. The fertilizer used as the most used nitrogen source is urea, which is applied preferably in the sowing.

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