Peruvian Journal of Agronomy 2 (1): 20 - 27 (2018)
ISSN: 2616-4477 (Versión electrónica)
DOI: http://dx.doi.org/10.21704/pja.v2i1.1130

Received for publication: 30 January 2018
Accepted for publication: 30 March 2018

Characterization of pineapple farms (*Ananas comosus* var. *comosus*) in Cuyani Microbasin, Pichanaki District, Chanchamayo Province (Junín, Perú)

Caracterización de fincas productoras de piña (*Ananas comosus var. comosus*) En la microcuenca Cuyani, distrito de Pichanaki, Provincia De Chanchamayo (Junín, Perú)

Maraví, J.[1], Buendía, O.[1], Alvarado, L.[1] , Borjas, R.[1], Castro-Cepero, V.[1], Julca, A.[1]
*Corresponding author: ajo@lamolina.edu.pe

Abstract

The study was carried out in the Cuyani Microbasin in the district of Pichanaki (Peru), with the main goal of describing pineapple farms. A sample of 31 producers out of a total of 45 was selected, using the "Proportions Method". In addition, a survey was conducted with questions related to economic, social, environmental aspects. It was found that the person in charge of the farm is mostly male, above 33 years of age and most of them with full high school education. The farm has a total extension between 1 to 10 ha, of which only 0.25 to 1.5 ha is planted with pineapple, mainly under a conventional production system, with yields ranging from 50 to 80 t / ha in varieties such as Hawaiian and MD2 (Golden) and consider that weeds and diseases are the most important limiting factors of the crop. The conglomerate analysis by the Ward Method with a square Euclidean distance of 1500 brought the farms together into five groups, the largest group comprising 38.7% of farms.

Keywords: Systems, farms, characterization, pineapple, survey.

Resumen

El estudio se realizó en la Microcuenca Cuyani en el distrito de Pichanaki (Perú), con el objetivo de caracterizar fincas productoras de piña. Se trabajó con una organización que cuenta con 45 productores de los cuales se tomó una muestra de 31 productores a través del "Método de Proporciones" y se realizó una encuesta con preguntas relacionadas a los aspectos económicos, sociales, ambientales. Se encontró que el responsable de la finca en su mayoría es varón, por encima de los 33 años y la mayor parte con estudios de secundaria completa. Tienen una finca de 1 a 10 ha; pero solo sólo siembran de 0.25 a 1.5 ha con piña, predomina el sistema de producción convencional, con rendimientos que van de 50 a 80 t/ha en variedades como Hawaiana y MD2 (Golden) y consideran que las malezas y enfermedades son los factores limitantes más importantes del cultivo. El análisis de conglomerado por el Método de Ward con una distancia Euclidiana cuadrada de 1500, reunió las fincas en cinco grupos, el más grande reúne al 38.7% de fincas.

Palabras claves: Sistemas, fincas, caracterización, piña, encuesta.

Introduction

The pineapple (*Ananas comosus* (L.) Merr. var. *comosus*) is an herbaceous species distributed in the tropics, originating in Tropical America. According to data from the Integrated System of Agricultural Statistics (SIEA), in 2014 the area harvested in Perú was 15,917 ha. Junín was the main supplier of the national market, which concentrates most of the land used for pineapple production (Mendieta, 2015); in 2015, it reached 6,200 ha in production, which represents more than 70% of national production according to the Central Reserve Bank of Peru Huancayo Branch (2016). The districts of Chanchamayo and Satipo are the ones with the largest area of cultivation in the central rainforest.

The pineapple culture in Peru has become an activity of great socioeconomic importance, with a great demand due to the nutritional properties such as vitamins, minerals, fibers and enzymes that contribute to a balanced nutrition. It is the fourth fruit with the highest national production, after banana, mango and grape with 124,700 MT, in the first quarter of 2017 (SIEA, 2017). In recent years, the pineapple production chain has generated employment and economic growth in the Peruvian rainforest, from the sale of seeds, to labor for various tasks, the use of machinery, marketing, etc. (Munive, 2015). The cultivars most commonly used in the central forest are 'Samba', 'Hawaiana', 'Cayena Lisa' and 'MD2'. The latter is also known as "Golden" and is aimed at fresh and industrial consumption and is widely accepted in the international market as being of high internal quality (Pac, 2005 quoted by Munive 2015).

On the other hand, agriculture in Pichanaki, as in most of the country, is an activity of small producers, that is, the agricultural units or farms are small. But the farms are very diverse and complex so it is necessary to make

[1]Grupo Investigación: Agricultura y Desarrollo Sustentable en el Trópico Peruano. Facultad de Agronomía. Departamento de Fitotecnia. Universidad Nacional Agraria La Molina. Lima (Perú).

a characterization as a previous step for any subsequent project (Santistevan et al., 2014); for Malagon and Praguer (2001), the characterization is a determining stage for the development of research in production systems. It consists of determining a set of variables that distinguish a particular production area or unit and that makes it different from others. Among other things, it seeks to distinguish the outstanding aspects for research in the selected area, identify the prevailing systems and identify the limiting factors.

In this sense, by grouping the farms according to their main differences and relationships, the aim is to maximize homogeneity within the group and heterogeneity among them (Cabrera et al., 2004). Therefore, this work was carried out with the objective of characterizing the pineapple farms (Ananas comosus var. comosus) in the Cuyani microbasin, Pichanaki district (Chanchamayo, Junín, Peru).

Materials and methods

The investigation was carried out in the Junín region, Chanchamayo province, Pichanaki district, in the Cuyani microbasin. It limits on the west with Bella Vista; on the east with Pichiquiari and on the southeast with Alto Pichanaki (Figure 1).

For this particular investigation, we worked with the most representative organization of the study area, which has 45 pineapple producers from which a sample of 31 producers was selected. The "Method of Proportions", already used in other similar researches, was used (Merma and Julca, 2012); the method has the following formula:

$$n = \frac{\frac{4PQ}{d^2}}{\frac{\frac{4PQ}{d^2} - 1}{N} + 1}$$

Donde:

n:	Sample size
N:	Target population (Universe)
P:	Success probability 0.5 (this value is usually assumed)
Q:	Error probability 0.5
d:	% error

they were surveyed on their own farms. Finally, a clustering analysis was performed by the Ward Method, with a Euclidean Square distance of 1,500.

Results and discussion

Characteristic of the pineapple producer. Figure 2 shows that the person responsible for the farm is mostly male (84%) and only 16% of the farms are managed by women. These results corroborate data from the National Agricultural Census (INEI, 2012), which showed that of every 10 farmers, about 8 are men and 2 are women in the Selva region. The age of the farmers is between 33 to 45 years (45%), 20 to 32 years (29%), 46 to 58 years (16%) and those over 59 years (10%). Likewise, the census data are consistent with the data obtained, as they indicate that the highest percentage of producers in the agricultural sector according to their age is registered in the group from 35 to 44 years old with 24.4%. The data obtained conclude that the largest group of pineapple producers are men between the ages of 30 and 45.

The educational level of the Pineapple farmers shows

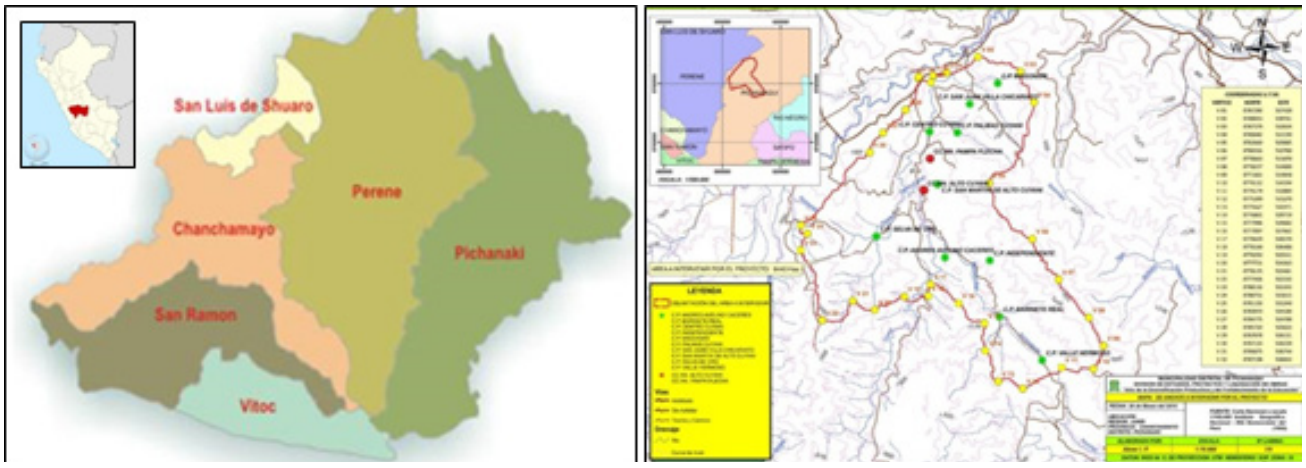

Figure 1. Map of the Pichanaki district and the Cuyani microbasin study area, Chanchamayo province, Junín region, Perú (Adapted from: MDP, 2015)

The data collection was carried out through semi-structured surveys, related to economic, social, environmental and technical management aspects for agricultural production. The surveys were carried out in the field, taking advantage of the meetings held by the community members, and to complete the information, that 65% of the ha most of them have completed high school education, 26% elemetary school education, 6% have not had any educational formation and 3% have a technical career at the Pichanaki Institute. Compared to the data of the 2007 National Census, there is a similarity, where 40% of the total population of the Pichanaki district are people who have completed elementary school education,

32% are people who have high school education and 16% do not have any educational level (Pichanaki District Municipality, 2016).

Farmers who live on their own farms or in neighboring towns, build them with mud (10%) and wood (35%); those who reside in Pichanaki and Cuyani Center, build them of noble material (55%). This is corroborated with the data of the Housing Census VI of 2007 that shows that the housing construction material that predominated was of noble material with 70.05% by the urban sector of Pichanaki, followed by 22.20% of wooden houses that represent the majority the rural sector and a minimum percentage of quincha and tapia (District Municipality of Pichanaki, 2016).

The coverage of basic services for farmers, such as water supply, drainage and electricity, is incomplete and inadequate in most rural areas, unlike in the urban sector. Forty-two percent of the producers who live in the towns and communities have water supplied by rivers and irrigation ditches, as well as electricity. Unlike the pineapple farmers who live in Pichanaki or Centro Cuyani, who have full basic services (58%). Data from the 2007 census indicate that 46.13% of the houses in the district have access to drinking water service, either through the public water network, direct connection, common pylon, truck, cistern, among others, and 53.88% are supplied by rivers, springs or irrigation ditches (Pichanaki District Municipality, 2016). The difference in results is due to the fact that the largest number of pineapple farmers surveyed reside in Pichanaki, so they have full basic services.

According to the research carried out in the Cuyani microbasin by the Pichanaki District Municipality in 2015, the main activity is agriculture. In the study area, it was found that 90% of the farmers depend on this activity and 10% have other incomes, as they work in state institutions and in the commercial sector. Regarding the type of breeding, 55% breed poultry, 13% breed birds and guinea pigs, 3% breed birds and pigs, 3% only breed guinea pigs, and 26% do not manage any type of breeding, as they are farmers that reside in Pichanaki (Figure 2).

Figure 2 shows that 48% of farmers do not belong to an organization, 42% indicated that they were members of the native Alto Cuyani or Pampa Arecha community; that is, farmers who rent fields from the communities indicated that they also actively participate in community meetings; and 10% of them belong to a coffee cooperative. Likewise, this organization is only just being established, so they are in the process of being legalized.

Characteristics of the pineapple farm: Of the farmers surveyed, 39% have between 6 and 10 ha of total land, 32% between 1 and 5 ha, 16% between 16 and 20 ha and 13% between 11 and 15 ha (Figure 3). However, 52% of producers also manage other traditional crops such as coffee (42%), bananas (35%), cassava (26%) and kion and corn (16%). According to the results obtained, they show that producers who do not have other crops handle more than 2 ha of pineapple, so they are completely dedicated to this crop.

The Pichanaki district had 340.85 hectares of pineapple in 2012, according to CENAGRO (RIABM, 2015). Plantations increased in this area, as it is a profitable crop and due to the coffee crisis in 2013. As a result, 48% of those surveyed have little experience, so they manage an area between 0.25 to 1.5 ha of pineapple, 29% between 2 to 3.5 ha, 13% between 4 to 5.5 ha and a smaller group (10%) that have between 6 to 7 ha (Figure 3). Those who have plantations of 2 ha to more, are producers who have many years of experience in the management of this crop.

The Ministry of Agriculture estimated in 2008 that there are about 14,000 hectares of pineapple with an average yield of 15 t/ha (P.E.P.P. 2010), but in 2015 the average yield in Chanchamayo was 36 t/ha and in Satipo 81 t/ha (D.E.I.A, 2016). In the present study, 39% obtained a yield of 70 to 80 t/ha per hectare, higher than the average yield in Chanchamayo, which is due to the fact that these farmers have experience in this crop; 22% obtained yields between 50 to 60 t/ha, which is considered an acceptable production; finally, 39% indicated that this was their first time managing the crop, so they do not know how much their average yield will be (Figure 3).

The investment made by a producer includes everything from renting the field, buying the seed, slashing, burning and cleaning, preparing the soil, disinfecting the seed, sowing, weeding, fertilization, sanitary control, induction of flowering, equipment and tools to be used. These are important tasks that must be performed for the management of this crop. In Figure 3, it is shown that 42% mentioned that their investment per ha varies between S/. 12,000 to 16,000, 23% invested between S/. 17,000 to 21,000, 6% between S/. 9,000 to 11,000, another 6% between S/. 21,000 to 30,000 and 23% do not know how much their investment will be, because the installation of the plantation is recent.

The highest production costs occur in farmers who grow the MD2 (Golden) cultivar, since the management is more laborious than the Hawaiian cultivar. According to data from the Regional Directorate of Agriculture of Junín, to produce Golden pineapple in a hectare of Satipo land, the farmer invests approximately S/. 30,000 with a profit of S/. 150,000 with good agricultural management (Inforegión, 2010). The Pichis Palcazu Special Project (2010) indicates that the calculation of the production cost for the pineapple case was not easy to determine, considering the different existing practices in each of the producing areas; in the case of the Samba cultivar, which is traditional in Chanchamayo, the investment is S/. 18,000 per ha, without technological package.

In Figure 3, it is shown that 35% of the farms have planted in a small to medium secondary forest; a secondary forest is forest growth, after a disturbance to the ecosystem that can be naturally or man-made (Giacomotti, 2016). The producers mentioned that their agricultural lands were previously coffee plantations affected by yellow coffee rust (Hemileia vastatrix), so they were abandoned for more

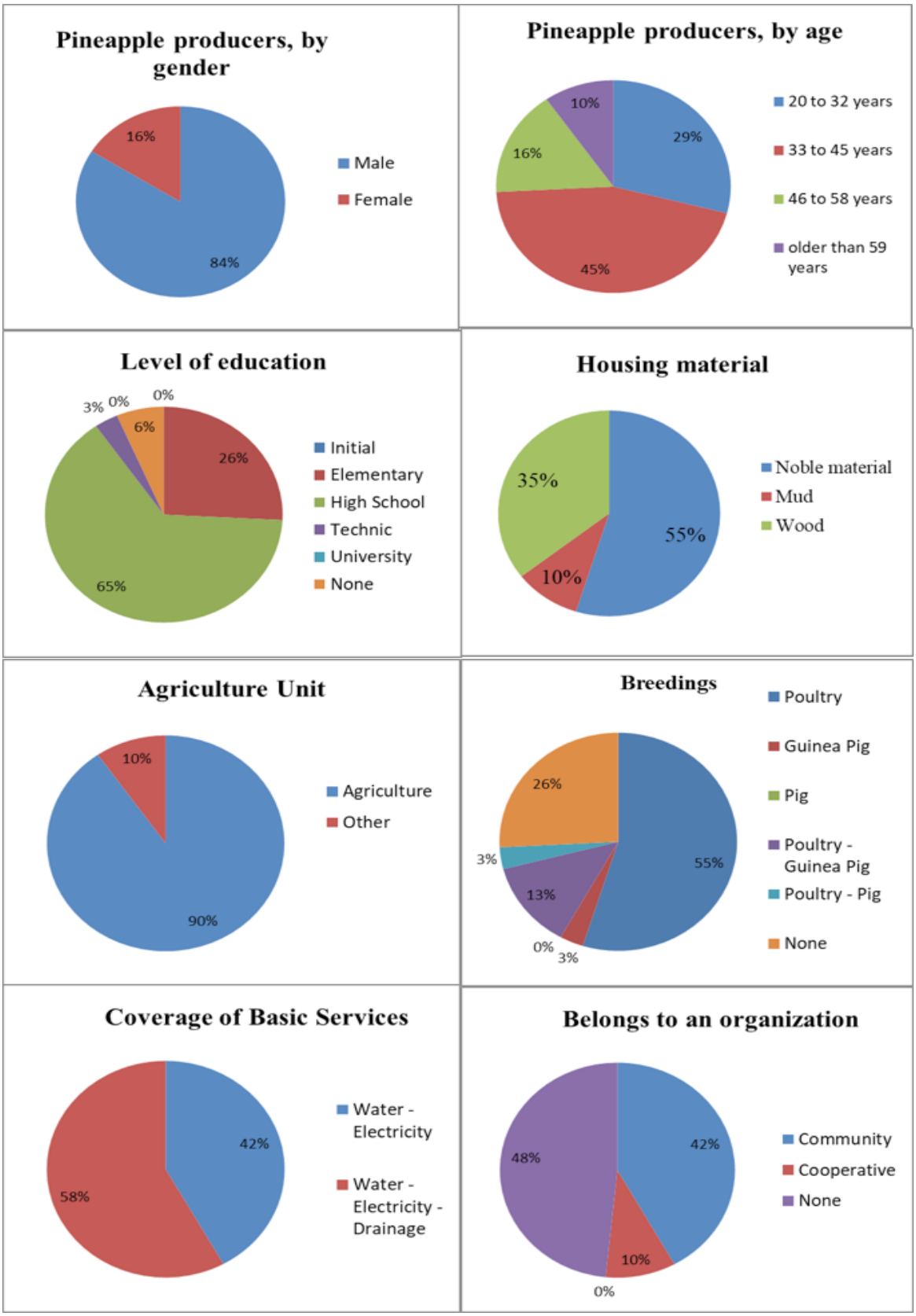

Figure 2. Socio-economic status of the pineapple producers in the Cuyani Microbasin, Pichanaki district, Chanchamayo province. Peru

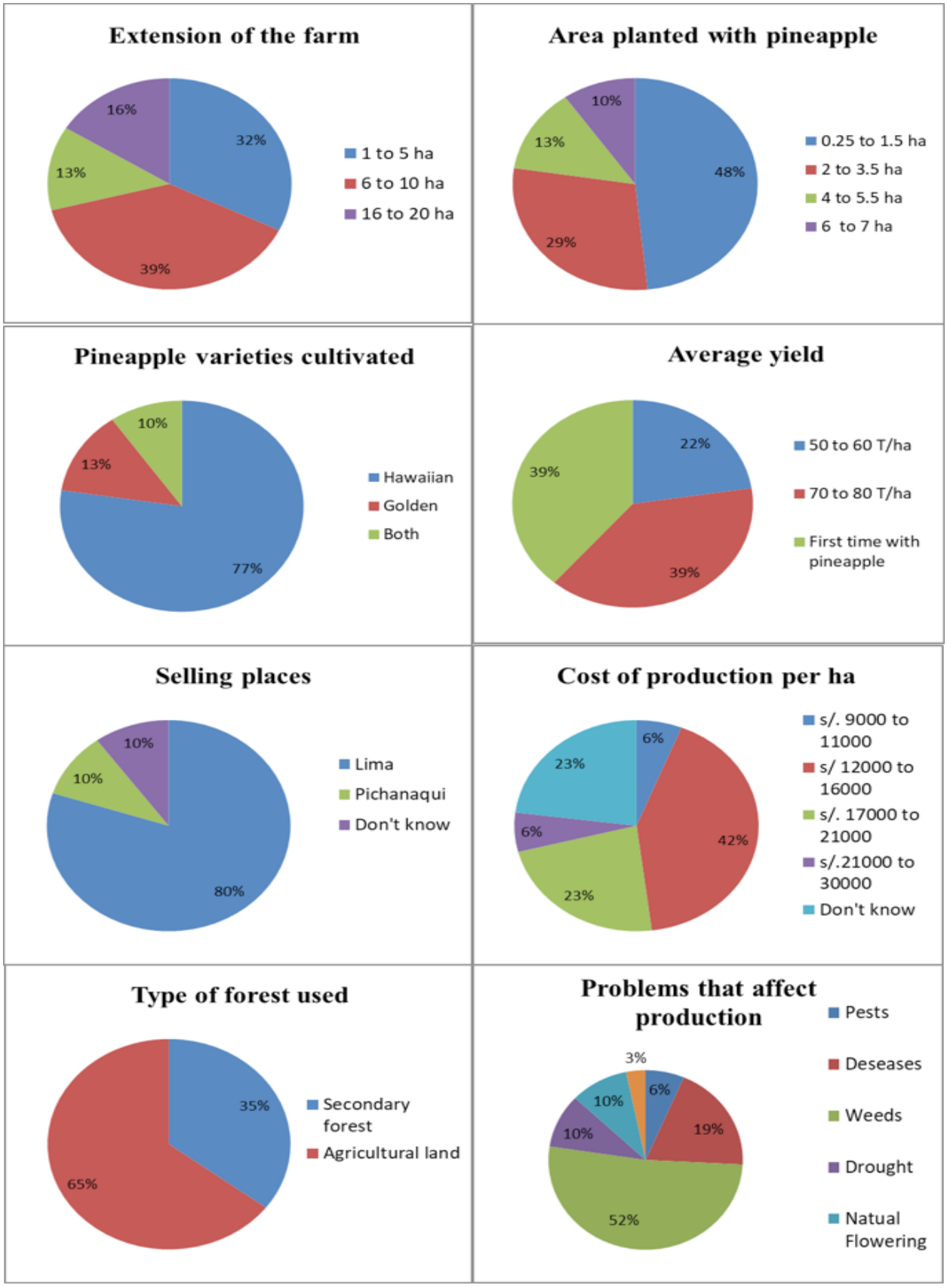

Figure 3. Economic and environmental characteristics of the pineapple producing farm in the Cuyani Microcuenca, Pichanaki district, Chanchamayo province. Peru.

than 3 years.

This type of vegetation has a successional character, that is to say, it begins with the development of a vegetation dominated by herbs, to give way to a tree vegetation that, over time, will assume a structure and floristic composition similar to the original forest, which will depend on the duration and intensity of previous use (Giacomotti, 2016). Sixty-five percent of farmers plant the same field where pineapple was previously planted. These are producers who have from 2 to more hectares and have experience with this crop. However, if plantations increase and there is no advice or adequate planning and control by public institutions, there may be negative impacts in the future. For example, Costa Rica is a large-scale pineapple producing country and due to agricultural expansion and the monoculture system, environmental and social problems have arisen.

In the year 2015 the extension of the Amazon rainforests was 68'188.726 ha which represent 53.06% of the national surface and correspond to 94.06% of the total forests. But the area lost is significant because in 2014 the accumulated loss of rainforest was 7.3 million ha (MINAM, 2016). Seventy-one percent of those surveyed mentioned that they do not own timber trees on all their agricultural property, as these fields are dedicated only to pineapple cultivation. Also, for the habilitation of the land, it is slash and burned, so that the wooded areas are lost. Twenty-nine percent of the respondents indicated that they did own timber trees, because they have other land without exploitation or because they manage shade crops, such as coffee (Figure 3).

Factors directly affecting production efficiency are involved in agricultural production; for 52% of producers, the presence of weeds is the biggest problem for their production due to the long growing cycle. On the other hand, when the field is not weeded in time, there is an increase in labor costs or the use of herbicides must be required to clean the field, putting production at risk. Likewise, weeds are alternate hosts of diseases and pests. For 19% of producers, the presence of diseases is the limiting factor for higher yields even in the case of the Hawaiian cultivar, which is tolerant. A 10% group indicated that drought and climatic instability was the main factor affecting the crop, as this affects the planting schedule and alters the crop cycle. Another 10% indicated that the natural flowering of the pineapple in the months of May to August causes losses in production, because it affects the harvest and sale of fruit. Six percent indicated pest damage as the main factor and 3% indicated disease and weed presence as the main factors (Figure 3).

Currently, the towns of Chanchamayo and Satipo use better technology than other areas of the country (P.E.P.P.P. 2010). Training in pre-harvest and post-harvest management by different companies, state institutions and NGOs such as Caritas, has enabled pineapple producer associations and small farmers to develop in this crop. Pineapple cultivation is very extractive, so the production system applied by the farmer will determine whether or not the soil is vulnerable to nutrient washing and erosion. According to the results obtained in this study, 10% of the producers surveyed in the Cuyani microbasin received the intervention of SENASA. Therefore, more institutional support is needed for small farmers to manage this intensive crop properly.

Productivity is a function of the amount of resources used (Fuente, 2012). Of the farmers surveyed, 58%

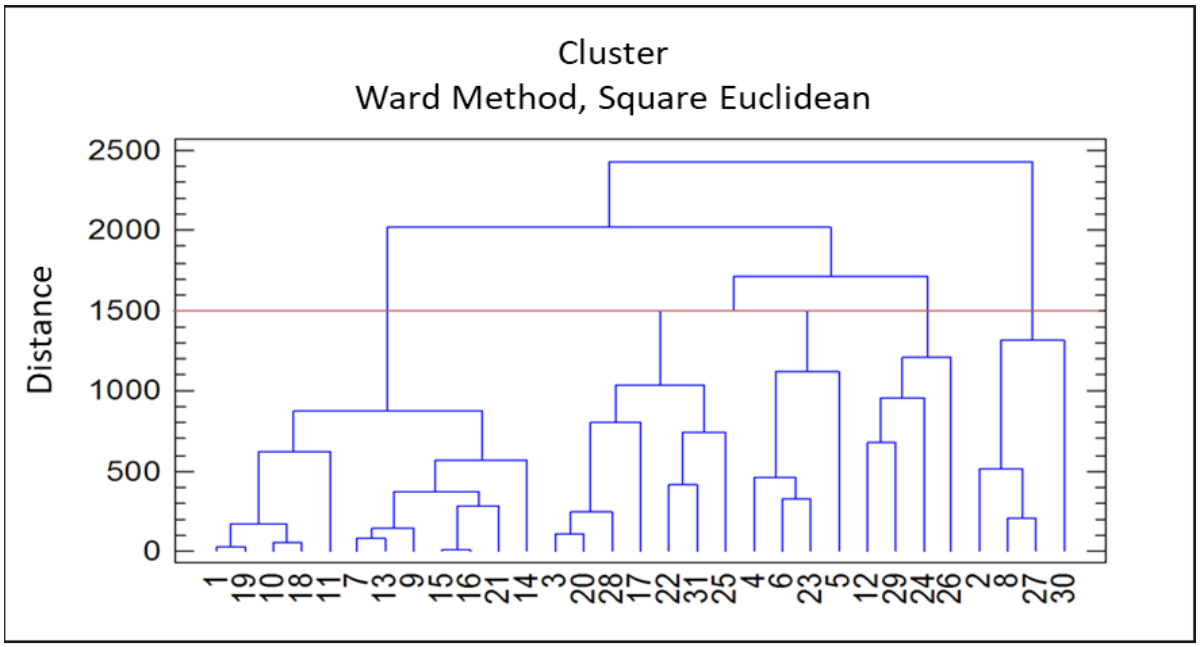

Figure 4. Cluster of pineapple producing farms in the Alto Cuyani microbasin, Pichanaki district, Chanchamayo Province.

indicated that they were satisfied with the productivity of their farm, as they obtained acceptable production and recovered their investment. 13% indicated that they are very satisfied, since last season production was profitable; a smaller group (6%) indicated that they were dissatisfied because their merchandise was sold in the Pichanaki market, with very low sales prices since they could not enter the Lima market because it was saturated, therefore, they did not make a profit. The last group of producers (23%), who are planting this crop for the first time, are not sure whether their production will be satisfactory.

Cluster analysis allows to group farms with similar characteristics. Grouping is important because future actions could be carried out for each group of farms and no longer on an individual basis. In this study, cluster analysis by the Ward Method and with a square Euclidean distance of 1000, classified the farms into five groups. The largest group (38.7%) is made up of farms: 1, 19, 10, 18, 11, 7, 13, 9, 15, 16, 21 and 14 (Figure 4). This group is characterized by the fact that the people in charge of the farms are men, their production system is conventional, they plant the Hawaiian cultivar and sell it in the wholesale market of Lima. They are not trained and consider weeds and diseases to be the main limiting factors of production.

Cluster analysis has been used by other researchers in studies with other crops. For example, to characterize coffee farms in Ecuador (Santistevan et al., 2014) and Peru to characterize citrus producing farms in Cañete (Collantes, 2016) and cocoa farms in San Martín (Tuesta et al., 2014).

Conclusions

The pineapple producing farms in the Cuyani micro-basin are very diverse. In general, a deficit of basic services is reported, a problem that should be addressed as soon as possible. The most widely planted variety of pineapple is Hawaiian and there is a lack of training, especially in the area of pests and diseases. This task should be assumed by the state with the aim of achieving the sustainability of the crop. Additionally, the result of the cluster analysis will be a very useful tool for decision-making and technology transfer in the future.

Acknowledgements

The National Fund for Scientific, Technological and Technological Innovation Development (FONDECYT), an initiative of the National Council for Science, Technology and Technological Innovation (CONCYTEC), through the project “Strategy and mechanisms for the governance of natural resources in the Pichanaki model forest of central Peru” (Grant Agreement No. 123-2015-FONDECYT).

Literature cited

Banco Central de Reserva del Perú. (2016). *Caracterización del Departamento de Junín.* Perú: BCP Sucursal Huancayo.

Cabrera, D., García, A., Acero, R., Castaldo, A., Perea, J. and Martos, J. (2004). Metodología para la caracterización y tipificación de sistemas ganaderos. IN *Documentos de trabajo producción animal y gestión*. España: Universidad de Córdoba.

Collantes, R. (2016). *Sustentabilidad de los Agroecosistemas de Palto (Persea americana Mill.) y Mandarina (Citrus spp.) en el Valle de cañete*. Thesis for the degree of Doctor. Universidad Nacional Agraria La Molina. Perú.

Dirección de Estadística e Información Agraria (DEIA). (2016). *Junín: Compendio Estadístico Agropecuario 1997- 2016.* Perú: DEIA.

Fuentes, S. (2012*). Satisfacción laboral y su influencia en la Productividad (Estudio realizado en la delegación de recursos Humanos del organismo Judicial en la ciudad de Quetzaltenango*. Bachelor’s Thesis. Universidad Rafael Landívar, Quetzaltenango, Guatemala.

Giacomotti, J. (2016). *Evaluación de la dinámica forestal en un área de Bosque secundario tardío en el Fundo La Génova, Chanchamayo*. Thesis for the degree of Forestry Engineer. Universidad Nacional Agraria La Molina. Perú.

Inforegión. (2010). *Satipo triplicó su producción de piña en los últimos cinco años*. [on line]. Perú. Available in http://www.inforegion.pe/79696/satipo-triplico-su-produccion-de-pina-en-los-ultimos-cinco-anos/. [March 13th 2018].

INEI (Instituto Nacional de Estadística e Informática, Perú). (2012). *IV Censo Nacional Agropecuario 2012*. Perú: INEI.

INEI (Instituto Nacional de Estadística e Informática, Perú). (2007). *VI Censo Nacional de Vivienda 2007*. Perú: INEI.

Malagon, R. and Praguer, M. (2001). *El enfoque de sistemas: Una opción para el análisis de las unidades de producción agrícola*. Palmira, Colombia: Universidad Nacional de Colombia.

Mendieta, P. (2015*). Producción de piña de enero a junio de este año alcanzó las 240,221 tn*. [on line]. Perú. Available in: http://agraria.pe/noticias/produccion-de-pina-de-enero-a-junio-de-este-9250. [March 20th 2018].

Merma, I. and Julca, A. (2012). Tipología de productores y sostenibilidad de cultivos en Alto Urubamba, La Convención–Cusco. *Scientia Agropecuaria,* 3(2), 149-159.

Ministerio de Agricultura y Riego. (2016). *Boletín Estadístico de Comercio Exterior Agrario. Sistema Integrado de Estadística Agraria*. Perú: MINAGRI.

Ministerio del Ambiente (2016). *Estrategia Nacional sobre Bosques y Cambio Climático*. Perú: MINAM.

Municipalidad Distrital de Chanchamayo, Perú. (2013). *Plan de desarrollo concertado 2013 – 2021*. p. 128-130.

Municipalidad Distrital de Pichanaki, Perú. (2016). *Plan de Desarrollo Concertado Del Distrito de Pichanaki 2016 – 2025*. p.56-69.

Munive, L. (2015). *Producción del cultivo de Piña cv. Golden en la Selva Central Mazamari – Satipo (Junín).* Thesis for the degree of Engineer. Universidad Nacional Agraria La Molina. Perú.

Pac, P. (2005). *Experiencias en el Cultivo de Piña (Ananas comosus (L) Merr.) con el Hibrido MD-2 en Finca la Plata, Coatepeque, Quetzal Tenango*. Guatemala: Universidad de San Carlos de Guatemala.

Proyecto Especial Pichis – Palcazu. (2010), *Manual de Piña. Proyecto Mejoramiento de la producción del Cultivo de la Piña Mediante Sistemas Agroforestales en el Distrito de Perené – Chanchamayo.* Perú.

Red Iberoamericana de Bosques Modelo (RIABM). (2015). *Plan Estratégico 2015 - 2018. Pichanaki*. Perú.

Santistevan, M., Julca, A., Borjas, R. and Tuesta, O. (2014). Caracterización de fincas cafetaleras en la localidad Jipijapa (Manabí, Ecuador). *Ecología Aplicada,* 13(2), 187-192.

Tuesta, O., Julca, A., Borja, R., Rodríguez, P., and Santistevan, M. (2014). Tipología de fincas cacaoteras en la subcuenca media del río Huayabamba, distrito de Huicungo (San Martín, Perú). *Ecología Aplicada,* 13(2), 71-78.