Metodología para la evaluación del nivel tecnológico del cultivo de Rye grass en los Andes ecuatorianos, microcuenca del río Chimborazo

Technological Level Evaluation Methodology of Rye grass cultivation in Ecuadorian Andes, the Chimborazo River watershed

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Resumen

La microcuenca del Río Chimborazo está ubicada en la Parroquia San Juan, provincia de Chimborazo, en la zona central de los Andes ecuatorianos. El 90 % de los habitantes son indígenas y hablan el Kichwa. Su extensión es de 12 460 hectáreas, de las cuales 27 % son pastizales. En promedio, cada vaca produce 6 litros de leche al día, lo cual se debe entre otros motivos a la mala calidad de los pastos. Se desconoce el motivo de esto último, así que se llevó a cabo un estudio que permite idear una metodología sencilla y participativa que determine el nivel tecnológico del cultivo y establezca científicamente la problemática en la implementación y manejo del pasto. Asimismo, con ello se busca definir si la tecnología agronómica hasta hoy desarrollada y aplicada en dicha área andina es sostenible.

La presente investigación se erige como base orientadora para futuros trabajos científicos agronómicos, de capacitación y asistencia técnica a desarrollar, con un enfoque de sostenibilidad

para las diferentes prácticas y fases del cultivo. Después del análisis correspondiente se reportan las deficiencias en las fases agronómicas del mismo.

Palabras clave: Niveles tecnológicos, Rye Grass, manejo eficiente de cultivos, Lolium multiflorum, microcuenca, río Chimborazo.

Abstract

The watershed of the river Chimborazo is located in Parroquia San Juan, province of Chimborazo, in the central zone of the Ecuadorian Andes. 90% of the inhabitants are indigenous and speak the Kichwa. Its extension is 12,460 hectares, of which 27% are grasslands. On average, each cow produces 6 liters of milk a day, due partly to the poor quality of the pastures. The reason for this last, is unknown so it was conducted a study allowing to devise a simple and participatory methodology which determine the technological level of the crop and scientifically set the problems in the implementation and management of pasture. Also, this is seeks to define if the agronomic technology so far developed and applied in the Andean area is sustainable.

This research stands as a guiding basis for future agronomic scientific work, training and technical assistance to develop, with a focus on sustainability to different practices and phases of the crop. After the corresponding analysis deficiencies in agronomic phases are reported.

Key words: Technological levels, Rye Grass, efficient management of crops, Lolium multiflorum, watershed, Chimborazo River.

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Introduction

According to the third national agricultural census 2000, 25% of the total surface of the Earth is covered by pastures. The Ecuador revealed that 41% of the soil for agricultural use is intended to pasture; and that between 1974 and 2000 these areas have increased by 70%, i.e., in recent decades there has been a clear trend towards livestock production. In the sierra this is explained by the high risk of agriculture, while the breeding of milk represents stable income. On the coast and in the

Amazon, the incorporation of pastures for cattle is done for economic purposes, causing serious problems related to forests logging.

According to INEC 2010, the country had 12,355,000 has productive, of which 38% are grasses. The use of the soil to be handled at national level for the development of natural pastures is 25. 2% and cultivated pasture is 74.8%.

The micro-watershed of the river Chimborazo is located in the Ecuadorian andes, is formed by a population which 93% is recognised as indigenous is Kichwa speaking, belonging to the nationality Puruhá.

Milk production in the watershed of the river Chimborazo is 6 litres per cow per day on average, this is due inter alia to the bad quality of the pastures, however, the reasons that generate this situation, are unknown, so it was necessary to conduct a study allowing to create a methodology to determine the technological level of the crop and to establish scientifically the problems in the implementation and management of this important grass to define whether it's sustainable or not with the agronomic technology so far developed and applied in the Andean area.

This research stands as a basis guiding of the agronomic scientific work, training and technical assistance to develop in the future with a focus on sustainability to different practices and phases of the crop. This allowed us to determine the sustainability of Rye Grass growing through a methodology that assesses their technological level in the watershed of the river Chimborazo, parish San Juan province of Chimborazo, Ecuador. Thus, theoretically it defined the efficient management of the crop Rye Grass, determining the level of technology practiced by farmers in the study area culture, and devising a proposal for technological improvement of the crop.

Method

Location

Geographic location

The Chimborazo River watershed is within the following boundaries:

Latitude: N 9825460

Length: 746 667 E

Altitude. 3300 m.s.n.m.

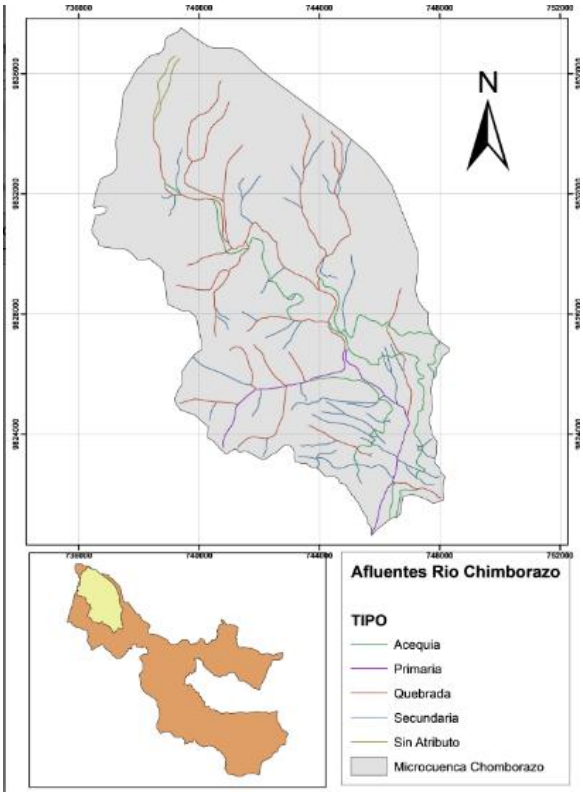

Figure 1. Map of hydrography of the river watershed Chimborazo.
Source: MAGAP 2012
Produced by: Eduardo Muñoz, César Cruz

Climatic characteristics

According decentralized self-government of the Parish San Juan (2012), climatic features are:

Temperature: 12 - 16 ° C

Rainfall: 500 - 1000mm

Relative humidity: 80 to 90%

Life zones

The reason this research area belongs to the living areas:

- **a.** Dry hilly forest (bs MB), this living area is located between 2900 and 3200 meters.
- **b.** Lower montane wet forest (bhMB), this area of life is among the 3200 and 3600 msnm.

Soil Characteristics

Soil taxonomy

Table 1. Orders soil in the watershed of the river Chimborazo

Orden	Extensión (Ha)	Porcentaje (%)
Entisol	625	5,0
Incetisol	6200	49,6
Mollisol	8	0,1
Histosol	2210	17,7
Nieve	925	7,4
Eriales	2522	20,2
Total	12490	100,0

Source: MAGAP 2012
Produced by: Eduardo Muñoz, César Cruz

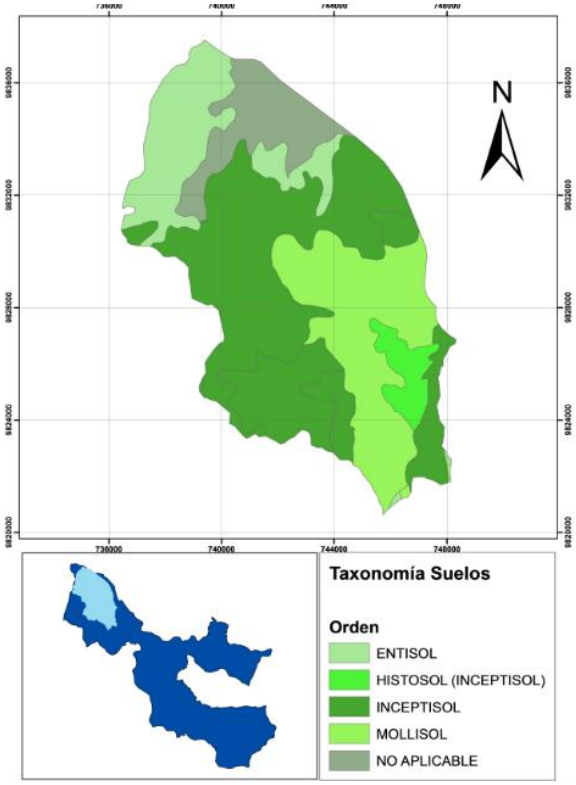

Figure 2. Map of Soil Taxonomy of the watershed of río Chimborazo
Source: MAGAP 2012
Produced by: Eduardo Muñoz, César Cruz

Current land use

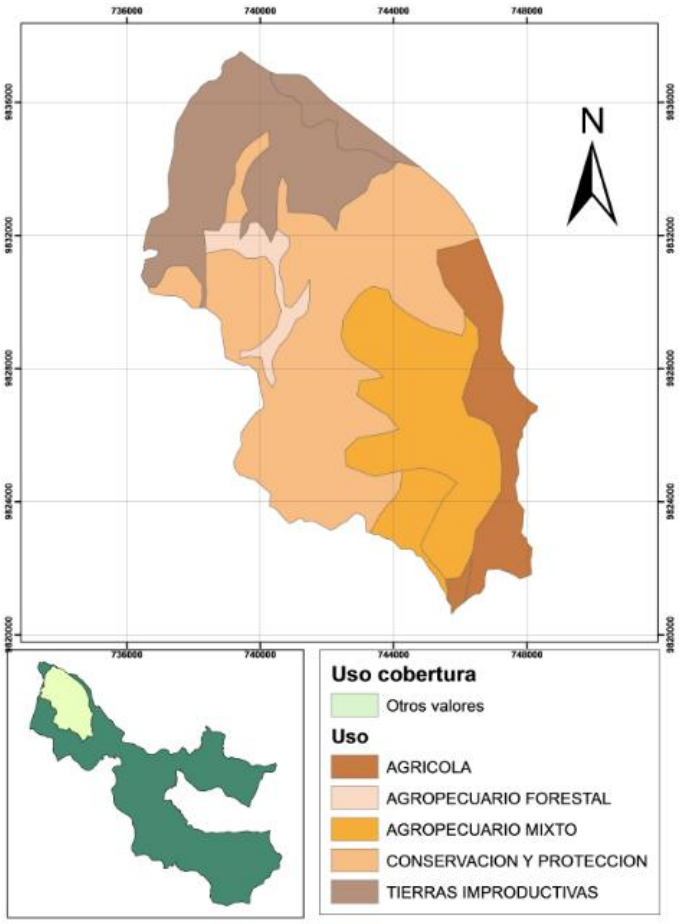

Figure 3. Map of current land use of the watershed of río Chimborazo.
Source: MAGAP 2012
Produced by: Eduardo Muñoz y César Cruz

Method for theoretical definition for the efficient handling of growing rye grass

Theoretical methods based on the collection of information on the efficient management of the crop of Rye Grass, considering agronomic practices for planting and grazing management phases of this culture was applied.

Method for determining the technological level Rye grass cultivation practiced by farmers in the study area

From the theoretical basis a methodology that allowed the analysis of the technological level crop of Rye Grass, considering variables activities and production phases are designed. Specifically, from the scientific theoretical support optimal efficiency or table that allows confronting the ideal crop management versus actual practice of farmers, determining the problems in each of its parts are developed.

Empirical methods of scientific research with the application of statistical analysis techniques that allowed for practical or agricultural activity associated with each phase by phase and overall culture were used.

It worked considering as universe crop producers Rye Grass belonging to the middle and lower River micro Chimborazo. To achieve the representativeness of the sample is the stratified.

Method for designing a proposal to improve culture technology

In a participatory manner with farmers they were made: the analysis of problems, objectives and alternatives defined logical framework matrix was designed.

Results and discussion

Efficient Rye grass growing from the theoretical analysis management.

Taxonomic classification

Kingdom: *Plantae*
Division: *Magnoliophyta*
Clase: *Liliopsida*
Order: *Cyperaceae*
Family: *Poaceae*
Subfamily: *Pooideae*
Tribe: *Poeae*
Gender: *Lolium*
Specie: *L. multiflorum* (Alarcón, A. 2007).

Botanical description

Habit and lifestyle

Planta herbácea anual, bianual o perenne (Rocalba, 2011).

Size

Up to 1 (1.3) m high (Rocalba, 2011).

Stalk

Cespitoso (agglomerated form clumps), erect or bent at the nodes (Rocalba, 2011).

Leaves

Leaf sheaths with atria (ears) conspicuous towards the apex; florets 1-4 mm long; sheet of up to 22 cm long and 8 mm wide, smooth on the underside, opaque and rough in the beam (Rocalba, 2011).

Inflorescences and spikelets

Solitary, sessile, alternate, 10-20 mm long with 4-22 flowers; glumes of 5 to 10 mm long, 5 to 7 rib, the lower absent, the second spine opposed to and shorter than half the length of spikelet; motto of 4-8 mm long, 5-7 ribbed, rounded on the back, something rough edges, with subapical edge of 0-15 mm long; Seed ± 4 mm long (Rocalba, 2011).

Zoning Rye Grass

The Rye Grass is considered the best forage option in temperate zones for its high yields, nutritional quality and ability to grow in a wide range of soils (Alarcón, A. 2007).

The Rye Grass has a high range of adaptation to soils, preferring well-drained fertile. Tolerate long periods of humidity and acid and alkaline soils (pH 5.5 to 7.8); when it is less than 5.0, aluminum toxicity can be a problem. Make a nutritional contribution of 12-18% crude protein in livestock feed (Alarcón, A. 2007).

Varieties

Rye Grass Inglés

The English Ryegrass is an excellent forage grass that perfectly develops fresh and healthy lands. It tolerates drought and high temperatures. It supports fine trampling and forage is very appreciated by all livestock. With proper management presence in the prairie can be more than four years to six years. It has a height of plant at the beginning of flowering of 30-35 cm (Rocalba, 2011).

Italian Rye Grass

The Italian Rye Grass forage grass is the most widely used of all. It is a biennial species that can last up to 5 years with proper management. It is similar to Rye Grass English but with longer and wider leaves with a lighter green color. The shank has edges. It has an easy implementation and behaves very aggressively. Fertile soils need to show all their productive potential. Plant height at beginning of flowering is 50 to 60 cm (Rocalba, 2011).
Rye Grass Westerwold

It is always used in pure stands for establishment of prairies of short duration and maximum output in the shortest time. Widely used in irrigation systems to produce large quantity of fodder and soon leave the field free to establish another crop. It produces high quality forage that can be used for both grazing and silage as well as for henificado. It has a height of plant at the beginning of flowering of 50-60 cm (Rocalba, 2011).

Hybrid Rye Grass

It is the result of crossbreeding between Rye Grass Rye Grass English and Italian, so that this species presents intermediate characteristics of both. Italian Rye Grass gets its scale and high productivity and the sustainability English Rye Grass, which is 3 years. Plant height at beginning of flowering is 50 to 60 cm (Rocalba, 2011).

Edaphoclimatic requirements

The Rye Grass has a high range of adaptation to soils, preferring well-drained fertile. Tolerate long periods of humidity (15 to 20 days) and acid and alkaline soils (pH 5.5 to 7.8); when it is less than 5.0, aluminum toxicity can be a problem (Alarcón, A. 2007).

Clementeviven, (2010) Indicates that the Rye Grass is well adapted to cold climates, with warm summer days and cool nights, it grows in all soils, tolerating up heavy soils, but in moist, fertile land is where best vegetate, one highly demanding in water and nitrogen, which is not well suited to drought and is very shade tolerant species.

The Public University of Navarra (2011) reports that the Rye Grass fits well in temperate humid climates. Tolerates moderate cold but is sensitive to heat and drought. Its growth slows from 25 ° C

and freezes at 35 ° C. It adapts to a wide range of soils. It has a good response to nitrogen fertilization, nitrogen-rich land is heavily developed, may dominate the grass. It supports compaction but can not tolerate waterlogging.

SIAN (2011) notes that the Rye Grass is grown at altitudes between 2200 and 3000 m, even though investigations by the National Institute of Agriculture of Venezuela Research has shown great development and effect in heights between 3100 and 3500 meters .

Implantation

Clementeviven (2010) notes that the Grass Rye presents a quick introduction, sprouts between 5 and 7 days after sowing, passing immediately to establish and protect the soil.

The Public University of Navarra (2011), says his initial growth is not as fast as the Italian Rye Grass but superior to other pasture grasses in the temperate zone; also having a persistence 4-5 years or more if conditions are favorable medium.

Seeding

Regional Livestock Union of Jalisco (2011) reports that to ensure the establishment of the prairie is recommended to use certified seed Rye Grass, which means commercial seed sowing 30-10 kg of seed per hectare.

Ducos, E. (2011), indicates that the planting is done at a dose of 20-24 kg / ha. When you are planting pure or associated with white clover, and proportionally smaller doses depending on the relationship you want to establish with other grass.

Sian (2011) notes that the Grass Rye is sown broadcast using 25 to 30 kg / ha of seed when natural Rye Grass, or employ 30 to 35 kg / ha of seed when Rye Grass hybrids are planted.

Planting methods

The way or method of planting depends on the machinery and equipment are available, but may be manual, broadcast storm or a hand drill. One voleadora properly calibrated fertilizer can also be

used, making the seed covered by branches harrow step ensuring that the seed is at a depth of 1.0-1.5 cm. of the soil surface (Regional Livestock Union of Jalisco, 2011).

Irrigation

During the period of accommodation will apply first watering after planting; It should be heavy and when gravity care not drag this seed. The second irrigation will be done 8-11 days, the third at 10-15 days. and fourth watering 15-20 days. This frequency of watering depends on soil texture; on sandy soils should be more frequent and in the case of clay soils, which are better able to retain moisture, care must be taken that the land no crusting, mainly during the first three irrigations (Unión Ganadera Regional de Jalisco, 2011).

Fertilization

Regional Livestock Union of Jalisco, (2011), indicates that for fertilization at planting is recommended to apply 80 kg of nitrogen and 60 kg of phosphorus per hectare. Equivalent to 175 kg of urea and 130 kg of superphosphate per hectare. The application of fertilizer is carried broadcast and incorporated into the soil with irrigation water. During the pasture utilization will be held after each cutting or grazing (about every 25-30 days); applying broadcast or irrigation water, 50 kg nitrogen per hectare, corresponding to apply 100-110 kg urea per hectare.

The Sian (2011), recommended to apply 350 kg nitrogen over 50 to 100 kg / ha of phosphorus and potassium per year. With a good fertilization program productions are achieved 18 to 20 tons of green matter per hectare per year, equivalent to 9 or 10 tons of dry forage per year.

Pasture rotation

The concept of rotation is based on the prairie, after being grazed book uses the nutrients it needs to recover and get enough rest to re-store them, because otherwise runs (Valencia, E. 2010).

From the above it follows that the rotation period has two parts, the grazing period (or occupation) and the rest (Valencia, E. 2010).

Additionally there are 4 laws that apply to rotational grazing:

- The rest period must be long enough.
- The occupation period should be short.
- The grass should be harvested as better quality animals with higher requirements.
- A dairy cow must not stay longer than three days in each paddock; the ideal is one day (Valencia, E. 2010).

Using the pasture

The forage should always be grazed and consumed at its peak: in the case of Rye Grass is considered 20-25 cm. Stage in which there is more number of leaves and cane is not hard (Masal, 2009).

Should not grazed grass below 5 to 7 cm. high, in order to promote a more rapid regrowth (Masal, 2009).

Grazing techniques

1) continuous grazing

When continuous grazing is used, ie animals have one pasture on which graze throughout the year, it is common for problems to occur by overgrazing or grazing sub (Masal, 2009).

Overgrazing occurs when a site is grazed too long with a large number of animals. Animals eat all they can decrease pasture reserves, which does not allow rapid recovery (Masal, 2009).

The sub grazing occurs when there are few animals in the pasture, they consume the most tender parts and sprouts of grass, leaving the stalks. As a result, the pastures "age", its nutritional quality decreases and the animals do not consume (Masal, 2009).

2) Grazing stake

This form of grazing is the best small beef farmers settles into communities with farms on hillsides or have very little grass installed (Masal, 2009).

Cows are tied with a rope about 6 meters long, moving the stake three times, about three meters each time. The grazing system can be used when it has less than 5 cows (Masal, 2009).

1) Grazing by strips

The recommendations for farmers who have settled in large numbers and in flat areas pastures or when has more than five cows; the system using electric fences is the most convenient (Masal, 2009). Each day moves two or more times the electric fence to give each time a new strip of grass to animals to be herded around the place and move to a new one.
This implies:

- Additional work for the management of the electric fence.
- A team and proper installation (Masal, 2009).

1) Rotational grazing

The recommendations for rural businesses and farmers who are able to invest in grids in addition to many animals. All pasture is divided into lots or pastures, where animals stay 1 or 2 days at most, from the next. The advantage of this system is that it can carry out practices of fertilizer, irrigation, cut to match the grass, and without disturbing other animals give more tender and better quality (Masal, 2009) grass.

Technological level crop of rye grass in the watershed of the river Chimborazo

To determine the technological level of cultivation in the watershed was identified:

Universe

Table 1. Number of families who cultivate community Rye Grass**.**

PARTE BAJA	
Organización Comunitaria	**Número de familias**
Comunidad Pisicaz Alto y Bajo	60
Asoc. Cantarilla	28
PARTE MEDIA	
Organización Comunitaria	**Número de familias**
Comunidad Chaupi Pomalo	43
Comunidad Calera Grande	90
Comunidad Calera Yumi	28
Comunidad Calerita Santa Rosa	42
Comunidad Shobol Llinllin	78
Comunidad Calera Shobol Pamba	72
Comunidad Guabug	132
TOTAL	**572**

Source: Plan Development and Land Management - San Juan Parish, 2012.
Produced by: Muñoz, E, Moreno, F y Coello, MJ, Cruz César 2013.

Sample

To calculate the sample using the following formula:

$$n = \frac{N \times p \times q}{(N-1) \times \left(\frac{e}{z}\right)^2 + p \times q}$$

$$n = \frac{572 \times 0{,}5 \times 0{,}5}{(571) \times \left(\frac{0{,}05}{1{,}96}\right)^2 + 0{,}5 \times 0{,}5}$$

$$n = 229$$

Stratification

To calculate the formula stratification is used:

$$(f) = \frac{n}{N} = \frac{229}{572} = 0{,}40$$

Table 2. Sample stratification by growing communities Rye Grass.

PARTE BAJA		
Organización Comunitaria	**Número de familias**	**Estratificación**
Comunidad Pisicaz Alto y Bajo	60	24
Asoc. Cantarilla	28	11
PARTE MEDIA		
Organización Comunitaria	**Número de familias**	**Estratificación**
Comunidad Chaupi Pomalo	43	17
Comunidad Calera Grande	90	36
Comunidad Calera Yumi	28	11
Comunidad Calerita Santa Rosa	42	17
Comunidad Shobol Llinllin	78	31
Comunidad Calera Shobol Pamba	72	29
Comunidad Guabug	132	53
TOTAL	**572**	**229**

Produced by: Muñoz, E, Moreno, F y Coello, MJ, Cruz César 2013.

Variables to determine the state of the crop practiced by farmers

Building on the literature review and considering the level of education of farmers in the study area 7% are illiterate, 60% have only primary education, and also speak the Kichwa language, the tables were produced in such a way that are easy to understand and apply

Table optimal for planting phase

Table 3. Variables for rating planting phase**.**

Variables para la calificación según práctica o actividad	
Siembra	
Variedad Perenne y anual	1
Densidad de siembra(66- 77lbs/ha)	1
Profundidad de siembra (1-1,5cm)	1
Con riego	1
Fertilización N y P	1
TOTAL	**5**

Elaborado Por: Muñoz, E, Moreno, F y Coello, MJ. 2013.

Theoretical Foundations adopted for qualifying phase planting

According to Hidalgo, E. (2010)., Ecuador has a large demand for grass seed production and does not have that must be imported. In agriculture the main imports from countries such as the United States, which imported 80.77% of all who entered Ecuador seeds; New Zealand 6.27% was imported; and 5.17% in the Netherlands.

Rocalba, (2011) indicates that a mixture of perennial and annual range is recommended.

Sian, (2011) points out that planting density is between 30 -35 kg / ha.

According to Regional Livestock Union of Jalisco, (2011) the seed must be at a depth of 1 - 1.05 cm of the soil surface.

According to the Regional Livestock Union of Jalisco (2011) irrigation was applied after planting.

With regard to fertilization, the Regional Livestock Union of Jalisco (2011) recommends applying nitrogen and phosphorus.

Table for grazing optimal phase

Table 4. Variables for the qualification of the grazing phase**.**

Criterios de calificación según practica o actividad	
Pastoreo	
Duración del pasto (5 – 6 años)	1
Tiempo de pastoreo (3 días)	1
Técnicas de pastoreo (estaca/franja/rotativo)	1
Altura del pasto (20 – 25 cm)	1
Riego en época seca (4 riegos) y fertilización	1
TOTAL	**5**

Elaborado por: Muñoz E., Moreno F. y Coello MJ, Cruz César.

Theoretical Foundations adopted for the classification of the grazing phase

According Rocalba (2011), the English and Italian Rye Grass on average can last for 5-6 years.

For Valencia, E. (2010), grazing time should be no more than 3 days.

According to Mashal (2009), the best techniques are grazing stake by rotating bands and because this way there is no overgrazing.

On the consumption of forage, Masal (2009) notes that should be consumed when having a height of 20-25 cm.

Regional Livestock Union of Jalisco (2011) directs that in the dry season should be performed four irrigations.

Rating scales

5 = excellent, 4 = very good, 3 = good; 2 = normal, 1 = poor

1 to 3 is considered practical problem; 4 is capable of being improved.

Initially and based on the theoretical foundations it is observed and describes the application or otherwise of each of the activities that are part of each phase.

Evaluation of the technological level in phases

To determine the level of technology in phases and taking into account the results of each practice or activity the five scale used to excellent, 4 to very good, 3 for good, 2 for normal, 1 for poor, establishing that even a score of 3 problem is considered, and 4 is capable of being improved.

Evaluation of the technological level of general culture

To assess the technological level of culture in general, the result of the 2 phases studied were added and the following scale was used: 10 excellent, with 8-9 very good, 6-7 good, 4-5 regular, retail 4 bad.

Technological level crop

Table 5. Use of annual and perennial varieties

PRÁCTICA	**FA**	**FAA**	**FR**	**FRA**
No usa variedad perenne y anual	148	148	65 %	65 %
Sí usa variedad Perenne y anual	81	229	35 %	100 %

Produced by**:** Muñoz E., Moreno F. y Coello M.

65% of farmers do not use varieties of annual and perennial Rye Grass ignorance, while 35% does.

Table 6. Implementation of proper seeding.

PRÁCTICA	FA	FAA	FR	FRA
No aplica la densidad de siembra (66 - 77 lb/a)	221	221	97 %	97 %
Sí aplica la densidad de siembra (66 - 77 lb/ha)	8	229	3 %	100 %

Produced by: Muñoz E., Moreno F. y Coello M.

The 97% of farmers, who are the majority, do not take into consideration the optimum planting density (67-77 lb / ha of seed), while 3% does.

Table 7. Planting depth recommended

PRÁCTICA	FA	FAA	FR	FRA
Sí siembra a una profundidad de 1.5 cm	229	229	100 %	100 %

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The 100% of farmers adequately deepen the seed at planting (1 - 1.5 cm).

Table 8. Practice irrigation

PRÁCTICA	FA	FAA	FR	FRA
No siembra bajo condiciones de riego	69	69	30 %	30 %
Siembra bajo condición de riego	160	229	70 %	100 %

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The 30% of farmers do not use the watering after planting, whereas it does 70%.

Table 9. Application of fertilization based on N and P in planting

PRÁCTICA	FA	FAA	FR	FRA
No emplea fertilización con N y P	206	206	90 %	90 %
Sí emplea fertilización con N y P	23	229	10 %	100 %

Produced by: Muñoz E., Moreno F. y Coello M.

The 90% of farmers do not fertilize the soil when planting, 10% does.

Table 10. Length of grass

PRÁCTICA	FA	FAA	FR	FRA
No dura el pasto de 5 a 6 años	52	52	23 %	23 %
Sí dura el pasto de 5 – 6 años	177	229	77 %	100 %

Produced by: Muñoz E., Moreno F. y Coello M.

To the 23% of farmers were grazing lasts 5 to 6 years, 77% achieved last at that time.

Table 11. Best time for grazing

PRÁCTICA	FA	FAA	FR	FRA
No emplea el tiempo de pastoreo 3 días	206	206	90 %	90 %
Sí emplea el tiempo de pastoreo de 3 días	23	229	10 %	100 %

Produced by**:** Muñoz E., Moreno F. y Coello M.

To the 90% of farmers pastors their animals for 3 days, while 10% do not.

Table 12. Application of proper grazing techniques

PRÁCTICA	**FA**	**FAA**	**FR**	**FRA**
Sí aplica técnicas de pastoreo (estaca/franja/rotativo)	229	229	100 %	100 %

Produced by: Muñoz E., Moreno F. y Coello M.

To the 100% of farmers grazing techniques (peg / band / rotary), generally use the stake method is performed.

Table 13. Management appropriate grass height

PRÁCTICA	**FA**	**FAA**	**FR**	**FRA**
No maneja la altura apropiada del pasto (20 – 25 cm)	170	170	74 %	74 %
Sí maneja la altura apropiada del pasto (20 – 25 cm)	59	229	26 %	100 %

Produced by: Muñoz E., Moreno F. y Coello M.

To the 74% of farmers makes a overexploitation when grazing (height 20-25 cm), while 26% do an adequate grazing.

Table 14. Supplemental irrigation

PRÁCTICA	**FA**	**FAA**	**FR**	**FRA**
No riega en época seca (4 riegos)	128	128	56 %	56 %
Sí riega en época seca (4 riegos)	101	229	44 %	100 %

Produced by: Muñoz E., Moreno F. y Coello M.

To the 56% of farmers do not water during dry periods (4 risks), while 44% does.

Table 15. Analysis of the technological level of the seed stage

Siembra	**EXCELENTE**	**MUY BUENO**	**BUENO**	**REGULAR**	**MALO**
	3 %	7 %	25 %	34 %	30 %

Produced by: Muñoz E., Moreno F. y Coello M.

According to the criteria, the results of the practices and the scale applied, with respect to the work in the seed phase, 3% of farmers is done in an excellent way, 7% very good, 25% good, 35 % Regular and 30% makes a poor job.

Table 16. Analysis of technological level of management or grazing phase

Manejo	**EXCELENTE**	**MUY BUENO**	**BUENO**	**REGULAR**	**MALO**
	10 %	16 %	18 %	33 %	23 %

Produced by: Muñoz E., Moreno F. y Coello M.

As for the work of the management phase, 10% of farmers is performed in an excellent manner, 16% very good 18% good, 33% and 23% regularly makes a poor job.

Table 17. General analysis of the technological level crop Rye Grass

CALIFICACIÓN	**EXCELENTE**	**MUY BUENO**	**BUENO**	**REGULAR**	**MALO**
RANGO	10	8 a 9	6 a 7	4 a 5	< 4
CULTIVO	3 %	7 %	18 %	33 %	23

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Rye Grass growing in general and in agronomic terms reported the following levels: 3% of farmers is done in an excellent way, 7% very good, 18% good, 33% and 23% regularly makes a bad seeding procedure and handling. With these results the practice of crop for most farmers is regular, meaning that the practices resulting from technological package created from the green revolution have not been adequate to the reality of indigenous farmers in the watershed of the river Chimborazo.

Proposal to improve crop management rye grass

It's designed and implemented based on the results of the evaluation of the technological level of the culture methodology, participatory proceeded to work on the proposal, presented it below.

Problem analysis

With the participation of those involved it was determined as key problem inadequate crop management due to two main causes: bad practices in planting and inadequate management practices; the first is to subcausa improper seeding depth, poor irrigation practices and inadequate fertilization. Inadequate management practices are given by use of old pasture, overgrazing and poor irrigation practices, as shown in Figure 1.

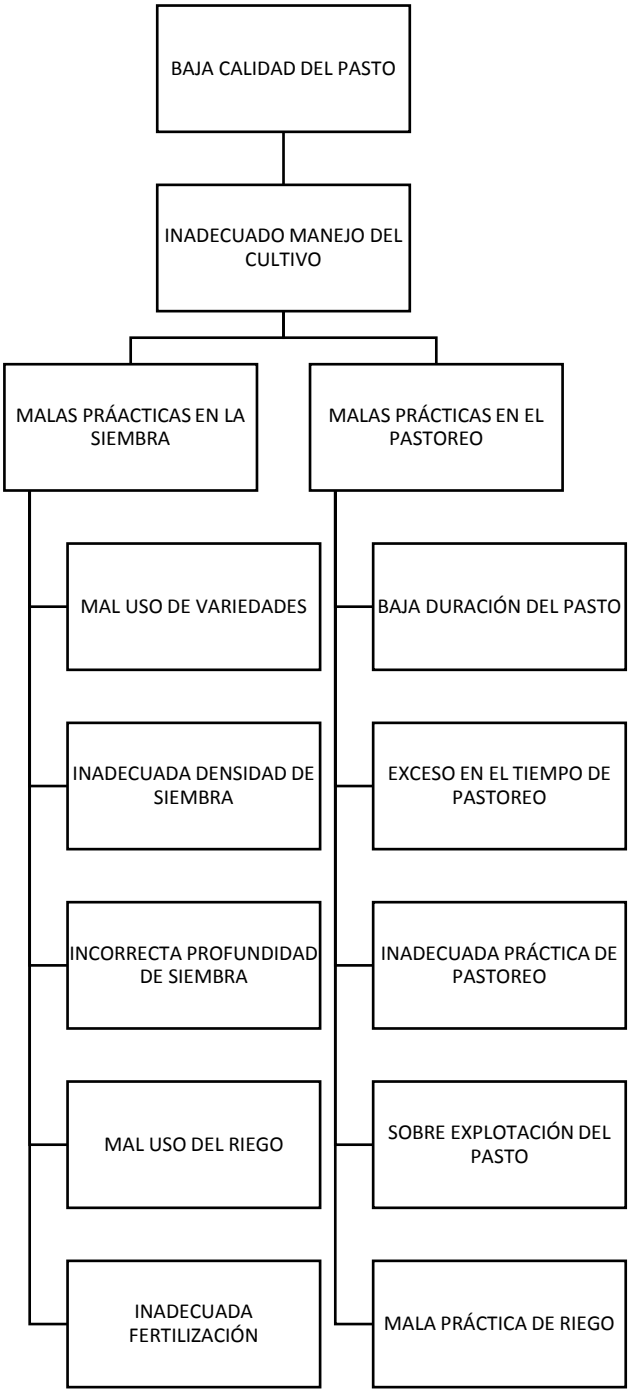

Figure 1. Analysis of problems related to growing rye grass in the watershed of the river Chimborazo
Source: Participatory workshops and evaluation of the technological level
Produced by: Muñoz E., Moreno F. y Coello M., Cruz César

Objective analysis

Also with the participation of stakeholders based on simple techniques, the above problem situation was transformed into a situation desired and achievable future, determining the objectives to be achieved with the proposal, the central problem became purpose, formulated as follows :

appropriate crop management, for which required two main aspects: adequate practices in planting and appropriate management practices; for the first compliance it requires proper planting depth, good practice irrigation and proper fertilization. Appropriate management practices are made possible by use of suitable pasture in relation to time, control of overgrazing and adequate irrigation practices, as shown in Figure 2.

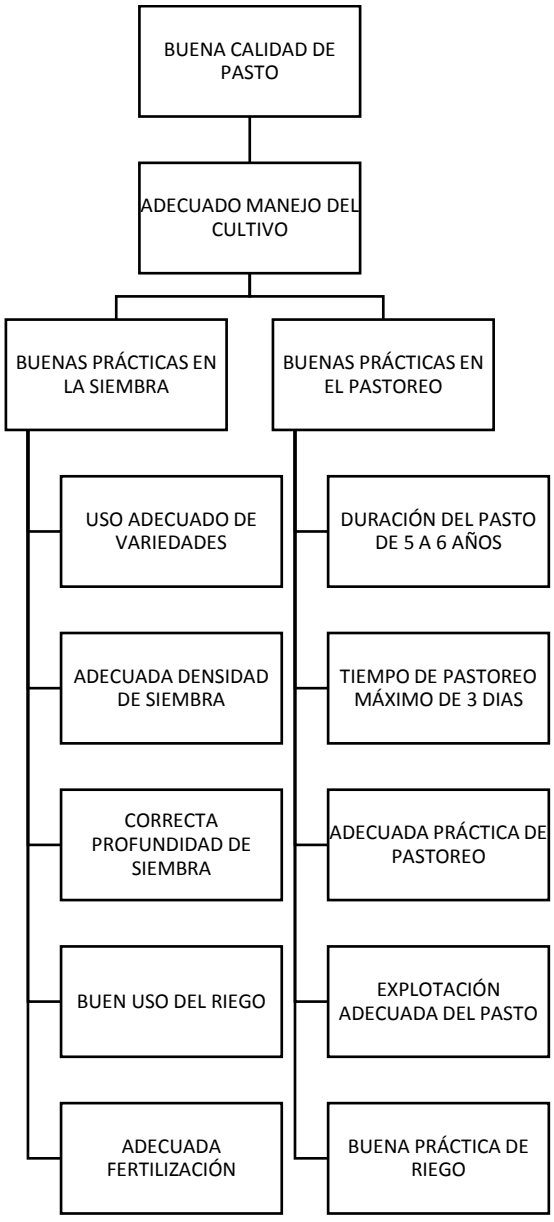

Figure 2. Analysis of objectives to improve crop production of rye grass in the watershed of the river Chimborazo
Source: Participatory workshops and evaluation of the technological level
Produced by: Muñoz E., Moreno F. y Coello M., Cruz César

Alternatives Analysis

To achieve participatory models the following objectives were defined alternatives:

a. Research and training in sustainable farming practices

b. Technical advice

Stakeholder analysis

Identified alternative solutions, passing them become strategies of the proposal, in total involved were identified who could contribute effectively to the implementation of the same. The analysis was made based on what is indicated in Table 18, which initially involved are characterized by the role and interests they pursue. Subsequently the most important notes about the potential, that is, those positive aspects which have and which can contribute to implementing the proposal is made. Limitations, understood as those aspects that hinder the participation of those involved, to finally establish the implications, that is, considering the aspects of the proposal at the project level to be met to overcome the limitations and exploit the potential of the then analyzed involved. It should be noted that the limitations are not a repetition of the problems reported in the evaluation of technological level.

Table 18. Analysis involved

INSTITUCIÓN	FUNCIÓN	INTERESES	POTENCIAL	LIMITACIÓN	IMPLICACIONE
Escuela Superior Politécnica de Chimbora	Investigación Vinculación	Desarrollar conocimiento Servir a la colectividad	Conocimiento Personal	Movilización	Asegurar la movilización
Gobierno Autónomo Descentralizado de la Parroquia S Juan	Administración de la microcuenca	Incentivar el desarrollo de actividades productivas comunitarias	Recursos Liderazgo	Falta de Técnicos	Asegurar los técnicos
Ministerio de Agricultura, Acuacultura y Pesca	Asesoría y Apoyo	Promover el desarrollo sostenible de la producción y productivida del sector rural	Recursos Técni	Tecnología	Capacitar Técnicos
Instituto de Investigaciones Agropecuarias	Investigación y Asesoría técnica Científica	Proporcionar tecnología y servicios especializados para impulsar la innovació agropecuaria nacional	Personal	Pocos técnicos	Asegurar los técnicos
Agricultores	Cultivar la tierra crianza de animales	Económicos Sociales.	Conocimiento ancestrales	Escasos recursos económicos Escasos conocimientos desde el enfoque de la revolución verde	Investigar prácticas ancestrales Generar conocimientos bajo enfoques sostenibles, sustentables y accesibles para agricultores Asistir técnicamente

Source: Talleres participativos
Produced by: Muñoz E., Moreno F. y Coello M., Cruz César**Marco lógico**

Based on the above analysis and based on the commitment of those involved parent of the proposal, which summarizes what must be executed to improve the implementation and crop management study was elaborated.

Table 19. Software for improving the agronomic crop management rye grass in the watershed of the river Marco Chimborazo.

Source: Talleres participativos
Produced by: Muñoz E., Moreno F. y Coello M. Cruz César

NARRATIVA DE OBJETIVOS	INDICADORES
Fin: Contribuir a la producción de pasto de buena calidad	1.1 Se mejora en un 80% la producción de pasto en los próximos 5 años
Propósito: Mejora el manejo del cultivo	1.1 El 80% de las familias de la microcuenca aplican prácticas adecuadas
Componentes	
1. Investigación y capacitación	1.1 Se desarrolla un paquete tecnológico con prácticas sostenibles en 1.2 base a investigación participativa
	1.3 Se realiza un curso de capacitación por mes en manejo de pastos para 30 jefes de familia, hasta cubrir al 80 % de agricultores.
	1.4 Se implementan 9 ensayos demostrativos en campo en cada una de las comunidades de la microcuenca.
	1.5 Se efectúa una visita de campo por mes a los ensayos demostrativos.
2. Asesoramiento técnico	2.1 Se da asistencia técnica diaria y permanente con un técnico por 3 comunidades

Conclusions

The methodology developed in a participatory manner involving mainly farmers; easy application, can detect deficiencies in the production process of Rye Grass and enable rapid planning to address the problems identified with precision in every practice that affects the cultivation of grass. For this technical assistance is used and, if necessary, further investigations.

Revised agronomic practices by farmers in the watershed of Chimborazo river to Rye Grass cultivation, planting phase accuses serious limitations, only 3% of farmers achieved an excellent rating in the phase of handling or grazing reaches 10% This rating, which affects the sustainability of the crop and milk production limits, limiting the well managed and good quality pasture.

The technological level of the culture in general of Rye Grass is qualified by most farmers as a regular and bad, which involves developing participatory research, linking internal and external

decision-makers to the watershed of Chimborazo river in generating technologies appropriate to reality Andean peasant and watersheds that can be adopted by farmers.

It is proposed to work in technical assistance, training and research based on the detected problem and depending on the logical framework which includes participatory planning done with farmers.

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