

Upcycling chochos (*Lupinus mutabilis*) Sustainable reuse of water from the hydrating process

De la Torre Avelina
American School of Quito/ Quito / Ecuador
Avelina2001@icloud.com



Abstract

Choco (*Lupinus mutabilis*) is a traditional Andean bean with a **very high nutritional value**. Chochos are grown, dried and stored for commercialization. Chochos need to be **processed** before their consumption because of the **presence of alkaloids** (natural repellent)



Photo 1. Chochos being grown in Chugchilán

Introduction

Choco, in English lupine (*Lupinus mutabilis*) is a bean with high calcium content and is an important part of the diet of the Ecuadorian population (Villacrés et al., 2018).

For their consumption, chochos require to be **hydrated** (Photo 2). Ninaquispe Zare (2013) reports that chochos obtain 68% of humidity during this process.

Chochos though contain a high amount of alkaloids. On my experimentation, the **unembittered water** was tested as irrigation water for crops.



Photo 2. Hydrated chochos

Objectives

- Analyze upcycling of the water used in the hydration process to unembitter chochos for use as irrigation water.
- Promote a sustainable consumption of chochos as Andean superfoods.

Experimental Design

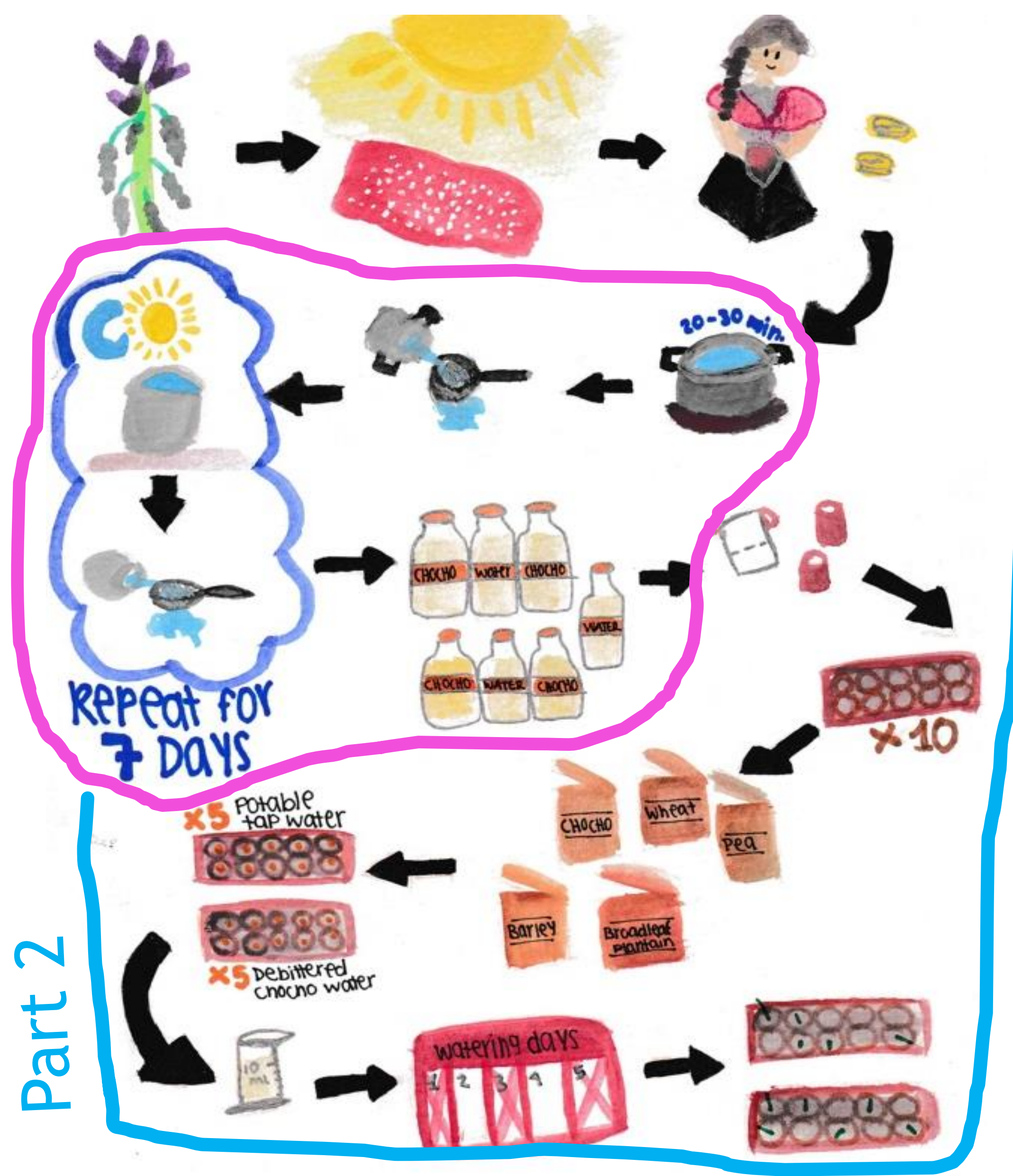


Figure 1. Process diagram

The experimental process was divided into two parts: 1) Hydrate the chochos and 2) Seeding. (Figure 1).

Chochos were left in water for seven days changing it daily. I stored this water in plastic bottles and used it later to water the plants. I placed 10 paper-roll tubes in 10 different pots and planted wheat, barley, peas, chocho and broadleaf plantain and watered the plants with 10 ml every two days.

Results and Discussion

I used two different types of water on the seeds. 5 pots were watered with potable tap water and the other 5 pots were watered with water used to hydrate chochos. After five days results were compared.

Results were: 33 sprouts for tap water (figure 3) and 28 sprouts for reused water (figure 4)

In addition, the pH testing on the chocho's water came to be around 4,8 and 5,8, slightly acidic, but not enough to affect the sprouting of seeds. (potable water was of 7.1, neutral)

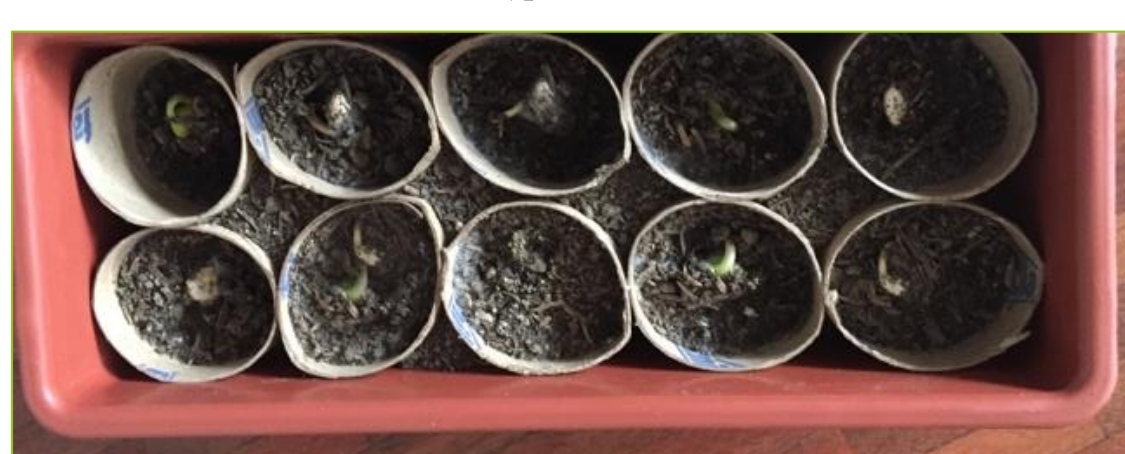


Figure 3. Choco's seedlings with tap type



Figure 4. Choco's seedlings with unembittered water

of sprouts

Plants	# of sprouts	
	Potable tap water	Debittered chocho water
Wheat	11	10
Barley	5	3
Pea	8	6
Choco	9	9
Broadleaf plantain	0	0
Mean	6.6	5.6

Table 1. Number of sprouts per water condition and mean germinations

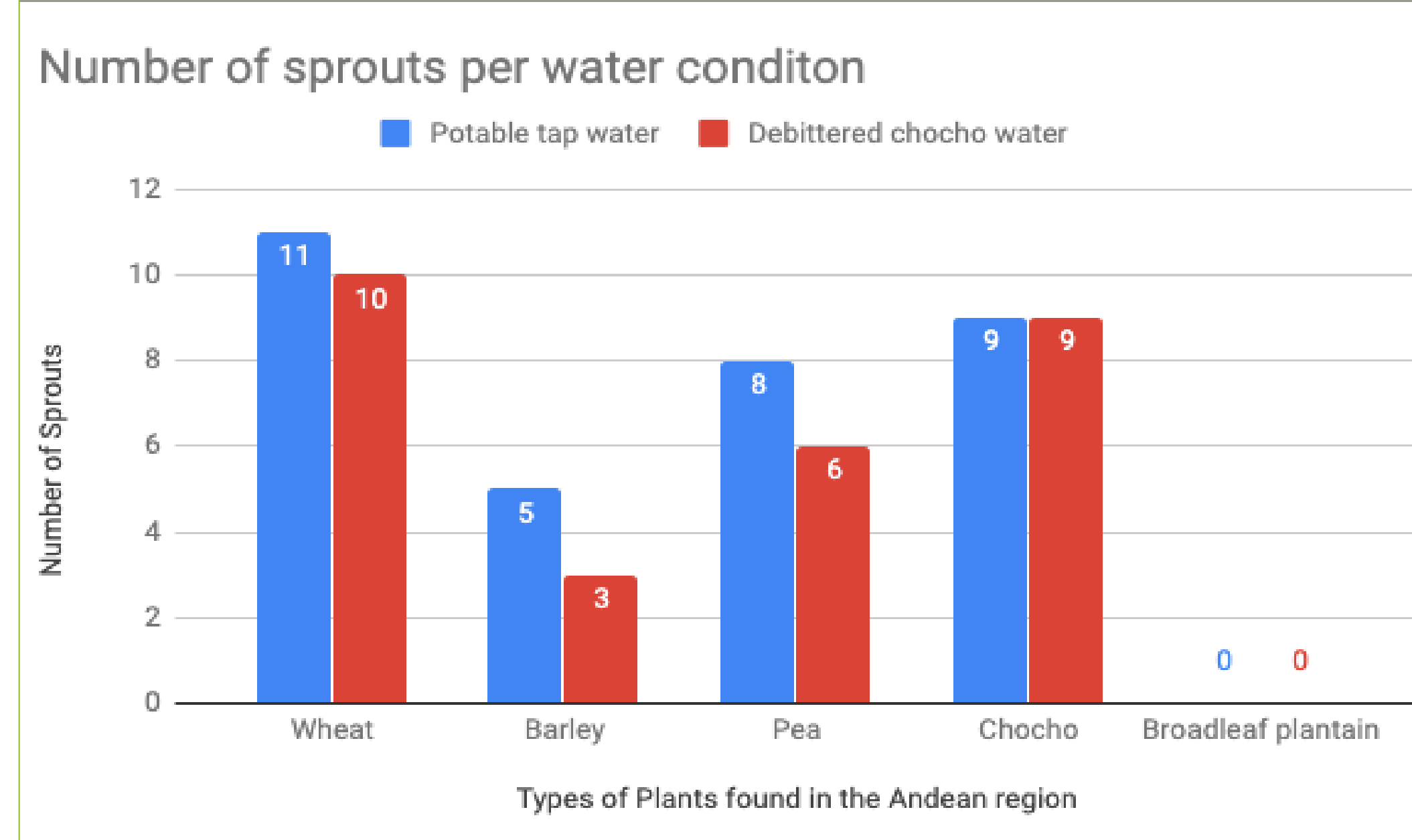


Figure 5. Graph, number of sprouts per water condition

Table 1 shows similar number of sprouts on chochos, suggesting that the two water types may have a similar effect on germination.

Due to a similar efficiency, it is appropriate to reuse chocho's water for irrigation since it helps reducing the amount of water disposed.

Conclusions

Re-using water from the hydration process could help **reduce the industry's water footprint** and **less water containing alkaloids get disposed** to nearby water bodies.

Upcycling unembittered water could be replicated in other regions of the world, i.e. on the Mediterranean coast of Spain and Italy an extended production of *Lupinus albus* known as "altramuz" can be found with a similar hydrating process (Huyghe, 1997).

The high nutritional components of these beans could make chochos enter other markets where the upcycling process could be applied.

References

- Huyghe, C. (1997). White lupin (*Lupinus albus* L.). *Field Crops Research*. 53. 147-160.
 Ninaquispe Zare, V. (2013) Secado del tarwi (*Lupinus mutabilis*) por métodos combinados: deshidratación osmótica y microondas con aire caliente. *Agroind Sci* 2: 155-164.
 Villacrés, E. (2018) Innovaciones tecnológicas del lupino (*Lupinus mutabilis* Sweet) para mejorar la salud y la nutrición. Paper presented at the I Congreso Internacional de Cereales y Leguminosas. Universidad del Azuay, Cuenca, Ecuador.