LIGHT INFLUENCE ON SEED GERMINATION OF CRAMBE *(Crambe abyssinica* Hochst)

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SUMMARY: With current incentives to search for sources of renewable energy, the culture of crambe (Crambe abyssinica) before, basically, to forage production, has been widely cultivated in order to produce vegetable oil. However crop science information for this culture still prove to be scarce in the scientific community. However, due to be culture that has taken new directions lately, and it presents a promising potential for the production of vegetable oils, studies with greater demand for commitment, are studies related to seed quality, aiming at the sustainable planting. The aim of this study was to evaluate the effects of light on seed germination of *Crambe abyssinica*. The statistical design used in the experiment was a completely randomized design with 2 treatments (absence or presence of light) and ten repetitions, totaling 20 experimental units. It is concluded that light is on promoting factor positive changes in seed germination of crambe. In the presence of light seeds of crambe showed higher percentages of normal seedlings and dry mass. Crambe seed was classified as neutral photoblastic.

Keywords: Crambre. Photoblastic. Luminosity.

INFLUÊNCIA DA LUZ NA GERMINAÇÃO DE SEMENTES CRAMBE *(Crambe abyssinica* Hochst.)

RESUMO: Com os atuais incentivos para a busca de fontes de energias renováveis, a cultura do crambe (*Crambe abyssinica*) antes, basicamente, destinado a produção de forragem, tem sido bastante cultivada visando à produção de óleo vegetal. Todavia informações fitotecnias para esta cultura ainda mostram-se escassas no meio científico. Entretanto, devido ser cultura que tomou novos rumos recentemente e apresenta-se com um potencial promissor para a produção de óleos vegetais, os estudos com maior demandam de empenho, são estudos voltados a qualidade de sementes, visando o manejo de plantio. O objetivo deste trabalho foi avaliar os efeitos da luz na germinação de sementes do *Crambe abyssinica*. O delineamento estatístico utilizado no experimento foi o inteiramente casualizado com 2 tratamentos (ausência e presença de luz) e dez repetições, totalizando 20 unidades experimentais. Conclui-se que a luz se constitui em fator promotor de variações positivas na germinação de sementes de crambe. Na presença de luz as sementes de crambe apresentaram maiores porcentagens de plântulas normais e de massa seca. A semente de crambe foi classificada como fotoblástica neutra.

Palavras-chave: Crambre. Fotoblástica. Luminosidade.

INTRODUCTION

The program and current incentives to search for sources of renewable energy make the culture of crambe (Crambe abyssinica) be highlighted to produce vegetable oil and appear like an

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opportunity to increase the farmers income.

The crambe is a cruciferous plant of the family, culture originating in the Mediterranean region, growing in a short production cycle, ranging from 90 to 100 days. Being a very robust plant, can develop antagonistic weather conditions. Preliminary studies show it has an oil content of about 35% by weight (MELO; FERREIRA; RODOLFO JUNIOR., 2005). The crambe crop is a winter culture because of that has attracted the interest of soybeans farmers, figuring one more alternative to the second growing season and also for crop rotation. Another important feature of that culture is the low cost and facility of production, whereas their crop uses the same machinery of soybean crop.

However the information about that culture must be more studied and revealed for improve the crambe culture reducing the production cost and increasing the profitability. Information such as fertilizer management, pest and diseases, harvesting technology and post harvest lack in the scientific comunity.

Anyway, the interest in crambe is three-fold (1) the seed oil is one of the richest known sources of erucic acid, (2) rapeseed oil, traditional erucic acid source, is being altered genetically to contain less erucic acid, and (3) crambe appears to be a better potential domestic crop than rapeseed (LESSMAN ; ANDERSON, 1981). There is a great concern in conducting studies that provide information about seed quality, especially with regard to standardization, streamlining and establishment of more efficient methods of analysis (BRASIL, 1992).

Absolute longevity depends on initial seed quality, which is controlled by genetic factors such as seed structure and composition, maturity, dormancy, purity, initial viability and vigor (JUSTICE ; BASS, 1978) and many aspects of plant growth and development are influenced by light. Seed germination is obviously a complex phenomenon and is generally believed that light factor is necessary and important for the germination of some species, which are called photoblastic. The light-mediated phytochrome system was also found to be involved in regulation of GA biosynthesis in some seeds (YAMAUCHI et al., 2004). The effect of light was associated with the increase of mRNA in GA-3-oxidase, the enzyme that catalyzes the final steps of the biosynthetic pathway of bioactive GA (YAMAGUCHI; KAMIYA, 2001). The classification of seeds in relation to light sensitivity is important for the conduct of germination (MAYER; POLJAKOFF-MAYBE, 1989).

Thus the basic study of seed germination show is great value, because other studies and guide also add information for the management of the culture. The objectives of this study were to investigate effects of light on germination of crambe (*Crambe abyssinica* Hochst.).

MATERIALS AND METHODS

All the laboratory tests were conducted at Seed Technology Laboratory, at Federal University of Espirito Santo (CCA-UFES), Espírito Santo state, Brazil. Seeds were obtained from MS Foundation, located in Maracujá – MS and the 2008 harvest were used as experimental material. The initial seed moisture was 10% and the statistical design was completely randomized with two treatments (absence or presence of light) and ten repetitions, totaling 20 experimental units.

The experiment was conducted with replicates of 25 seeds for each treatment, distributed in Petri dishes with a diameter of 11 cm, cover with filter paper with specific weight of 80 gm^{-1} and porosity of 3 µ, moistened with 15 mL of distilled water. The plates were kept in a germination chamber BOD adjusted to 25 º C, equipped with fluorescent white light and cool, with a photoperiod of 8-16 hours (light-dark) as described in the rules for seed testing (BRASIL, 2009). The absence of light was obtained by the involvement of the Petri dishes in two black plastic bags.

The number of germinated seeds were assessed daily for 12 days, the germination considered effective from the primary root protrusion of about 2 mm for calculation of GSI, made according to Maguirre (1962).

In the final of experiment, we calculated the percentage of normal seedling germination and abnormal seedlings, hardseedness, dead seeds, root length and shoot length in cm; fresh and dry weight in grams. Since the germination data was calculated daily rate of germination in time (LABOURIAU ; VALLADARES, 1976).

Analysis of variances ($p \leq 0.05$) were performed on the data with the the Software SISVAR 4.0 (FERREIRA, 2008) and Tukey's multiple range test was used in the significant mean comparisons.

RESULTS AND DISCUSSION

The average of seeds germination subjected to the presence of light with a photoperiod of 8-16 hours (light-dark), were higher than those seeds subjected to continuous darkness (Table 1). Light is considered a requirement for germination of a lot of plant species,but depending on the adaptability to environmental conditions, plants may have different answers to that environmental factor (GIVNISH, 1988; SEEMANN, 1989).

The action of light on germination is mediated by phytochrome. The phytochrome is a family of five distinct forms (A, B, C, D and E) encoded by several genes. It happens to the germination, the DNA encoding this activity must be cured, this happens through a chemical signal provided by phytochrome, which by absorbing light, functional structure and is cast as a chemical

signal, that the early germination. This process is influenced by the wavelength and intensity of light (CASAL; SÁNCHEZ, 1998).

This result would classify species as photoblastic due to the response to light stimulation. However, germination was not restricted to the presence of light, since it also occurred in continuous darkness, despite significantly lower. Thus detects that the species has no specific need light for germination, so it should be classified as neutral photoblastic (LOPES et al. 2005).

It is emphasized that this category of neutrality, cannot be considered as definitive, since other factors can alter their characteristics photoblastic (TAKAKi, 2001). Other species have seeds that are indifferent to light as Albizia lebbeck (DUTRA; MEDEIROS FILHO; DINIZ., 2008), Leucaena leucocephala (SON, 2008), Basella rubra (LOPEZ et al., 2005), Aesalpinia peltophoroides (FERRAZ-GRANDE ; TAKAKI, 2006) and Tabebuia chrysotricha (SANTOS; SUGAHARA; TAKAKI, 2005).

In the study of seed germination, due to light stimulus, should note the sensitivity of the seed can also be altered by other factors such as seed age, storage condition and dormancy (BEWLEY; BLACK, 1994).

The highest germination speed index (GSI) was obtained with the presence of light (Table 1). Even the seed of crambe were neutral treatment photoblastic note that in the absence of light, the GSI was lower. Denotes that in the absence of light stimulus in the centers of reactions were happening in stages and divided the germination process in function of period times. An germination speed index (GSI) lower at the field, it becomes uninteresting as it provides an uneven plant population, complicating the management of culture (NEIVA, 1997).

The germination rates provide information about the characteristics of germinated seeds of groups assessed in specific treatment; period and speed of germination allow further interpretations (BORGHETTI; FERREIRA, 2004).

Table 1. Mean percentage germination (G) and germination speed index (GSI) of crambe seed in the absence and presence of light [1].

Light	**G**	**GSI**
Presence	80.00 a	5.14 a
Absence	54.00 b	1.57 b
CV (%)	1.79	4.52

[1] Means followed by the same letter in a column do not differ significantly by the Tukey test at 5 %.

In the presence of light, there is a higher average of normal seedlings and lower averages of abnormal seedlings when compared to continuous dark (Table 2). Then a new system is presented, displaying the seedlings germinated in the dark do not appear viable. Even though there are

germination in the absence of light, these seedlings will certainly not end the cycle of cultivation, increasing the production costs.

The number of dead seeds for treatment under intense dark was higher than the number of influenced by light treatment (Table 2). Relates this fact, not only the lack of stimulation of the centers of transformation of light, but also at a significant level of dormancy that the species may present (RUAS et al., 2010).

This loss might be caused by interference in several physiological processes vital to plants, as in the blocking water and nutrient transport. As a result, there has been less development of vigorous and productive plants, very sensitive to any kind of stress and vulnerable to attack by pests and diseases (MENTEN, 1991).

Table 2. Average percentage of normal seedlings (NP), abnormal seedlings (AP), hardseedness (HS) and dead seeds (DS) in the germination of seeds of crambe under the absence and presence of light[1].

Light	NP	AP	HS	DS
Presence	71 a	9 b	5 a	15 b
Absence	13 b	40 a	7 a	40 a
CV(%)	1.47	2.34	2.17	2.80

[1] Means followed by the same letter in a column do not differ significantly by the Tukey test at 5 %.

In the presence of light seeds showed higher values in mean shoot length and seedling dry and fresh matter weight (Table 3). This can be explained because, in addition to provide the conditions necessary for germination, seeds under to light stimulus, produce seedlings with higher growth rate, due to have a higher processing capacity and supply of reserves from storage tissues and greater incorporation of these the embryonic axes (DAN et al., 1987).

Table 3. Mean root length (RL) and shoot lenght (SL) (cm), fresh matter (FM) and dry matter (DM) (g) in the germination of seeds of crambe under the absence and presence of light[1].

Light	RL	SL	FM	DM
Presence	6.03 a	8.61 a	0.685 a	0.036 a
Absence	5.98 a	7.10 b	0.428 b	0,009 b
CV (%)	3.34	4.74	1.60	4.17

[1] Means followed by the same letter in a column do not differ significantly by the Tukey test at 5 %.

The curve of distribution of germination, showed a higher germination index of the crambe seeds and crescent in the early days, with the point of inflexion on the second day. The second day of germination frequency is decreasing. Note that the frequency curves of germination for the presence and absence of light stimulus are similar, differing only in the amplitude of the curves, where the light treatment was superior to the absence of it (Figure 1).

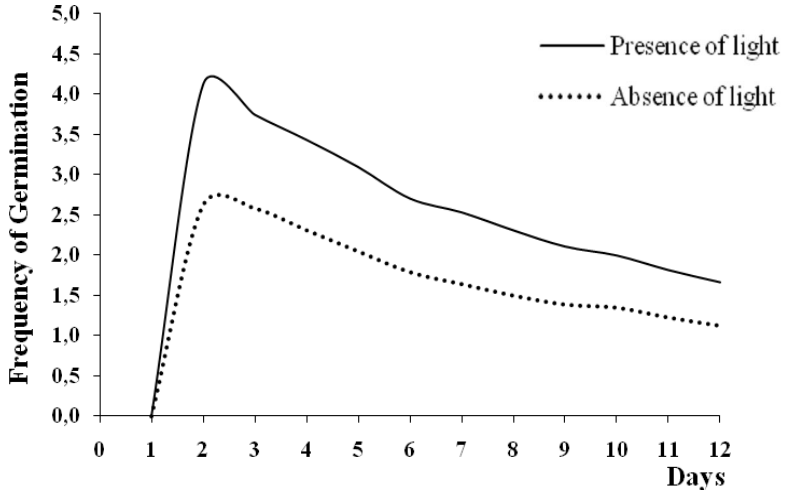

Figure 1. Relative frequency of germination of crambe in the absence and presence of light.

The ambiguity in the variables analyzed to the response of light, observed for the seeds of crambe is an indicator of that specie adapt in light and dark conditions. According to Borghetti ; Ferreira (2004), species that grow under dense vegetation canopy do not demand in general lots of light while species that develop in open areas without vegetation, like the crambe abyssinica, demand relatively large amounts of light germination to occurs.

CONCLUSIONS

- The light promote positive changes in the germination of crambe.
- In the presence of light, seeds of crambe showed higher percentages of normal seedlings and dry mass.
- Crambe seed was classified as a neutral photoblastic.

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