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RESPONSE OF VELVET BEAN SEEDS UNDER THE BURNING OF SUGARCANE STRAW

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ABSTRACT **-** Mucuna-preta (Mucuna aterrima) become a troublesome forage crop when bad manage due to staggered seed's sprout. Therefore, evaluate the response of mucuna-preta seeds after a simulation of a burning sugarcane crop. Carried out a two field experiments, 50 seeds were distributed randomly in 0,25 m^2 on soil surface (0 cm), at 2 and 5 cm of depth and in wire meshes at 50, 100 and 150 cm above soil surface. The velvet bean seed's germination is effected when seeds are near or until 150 above soil surface during a sugarcane burning.

Keywords: Mucuna aterrima, Cover crop, Germination

RESPOSTA DE SEMENTES DE MUCUNA-PRETA SOB A QUEIMA DA PALHADA DA CANA

RESUMO - A mucuna-preta (Mucuna aterrima) torna-se uma forrageira problemática quando mal manejada devido a germinação escalonada das sementes. Portanto, avaliou-se a resposta de sementes de mucuna-preta após a simulação da queima de canavial. Conduziu-se dois experimentos em campo, 50 sementes foram distribuídas aleatoriamente em 0,25 m^2 na superfície do solo (0 cm), a 2 e 5 cm de profundidade e em telas metálicas a 50, 100 e 150 cm acima da superfície do solo. A germinação de sementes de mucuna é afetada quando estiverem mais próximo ou até 150 cm acima da superfície do solo durante uma queima de canavial.

Palavras- chave: Mucuna aterrima, Forrageira, Germinação

INTRODUCTION

The velvet bean can be used in the renovation of sugarcane, weed suppression, control of nematodes and green manuring. However, the acceptance of this species in the renewal of sugar cane fields has been little use at the present time due to its potential risk of becoming a difficult weed to control. Management of this species after seed maturation, may interfere the harvest of sugarcane. According to Marcos Filho (2005), seed germination and emergence of velvet bean in the soil are scattered even during sugarcane growth. Seed dormancy is a responsibility of testa, with the goal of species survival. The seed properties as impermeability, biotic and abiotic resistance, and hardness, might be related to testa color. In the legume family, seeds with brighter testa are less resistants and easier to absorb water, unlikely to seeds with dark testa which are more resistants and difficult to absorb water (SMÝKAL et al., 2014).

The mechanical harvesting of sugarcane leaves a residual straw, from the top of plant, moreover; make a thick layer of straw to block light penetration and manage weed that are positive photoblastic. Even though, the thick layer of straw does not control species as velvet bean for having high seed reserve, also the seeds do not need much light to sprout. The interaction of water, soil and seed testa of velvet bean, still unclear, because there is report about fire and fog from the burning of cane straw for controlling seed germination in some weeds (RIPLEY et al., 2010). Aiming to investigate the influence of fire and fog from the burning of cane straw in velvet bean seed germination, a field and laboratory research was carried out.

MATERIAL E METHODS

The field trial was carried out from October to November of 2013, at experimental area of Universidade Federal de Jataí. The soil was Latossolo Vermelho distroférrico with clay 64.52%, silt 18.84% and sand 16.64%. Used 20 Mg ha-1 of cane straw from the cultivar SP 813250, to simulate the burning of sugarcane field (Graphic 1).

First trial set in randomized complete block design with five replication and four treatments. Laid the cane straw over the soil, with 50 velvet bean seeds scattered in 0,25 m^2 at soil surface, over the cane straw, 2 and 5 cm deep from the soil surface, also added a check treatment which seeds did not have any contact with the burning

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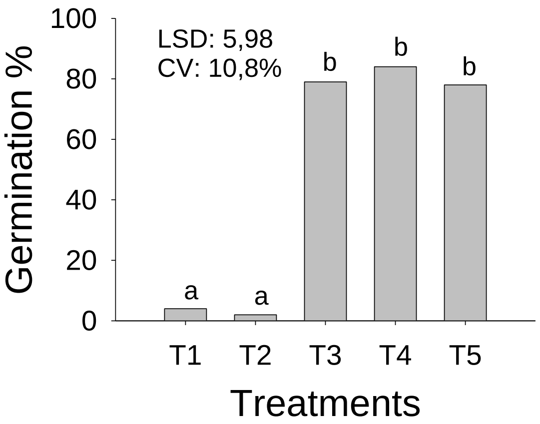
of cane straw. After the burning, the seed from each treatment were taken to the laboratory, sterilized in sodium hypochlorite at 2% for 5 minutes followed by ethanol at 70% at 2 minutes, after rinsed the seeds in distilled water three times to remove any pathogen left. Finally, seeds were ready for germination test in roll paper moistened by distilled water on B.O.D incubator at 27°C with 18h of photoperiod. Germination analysis started at the third day and finished at tenth day, by counting daily the seeds germinated.

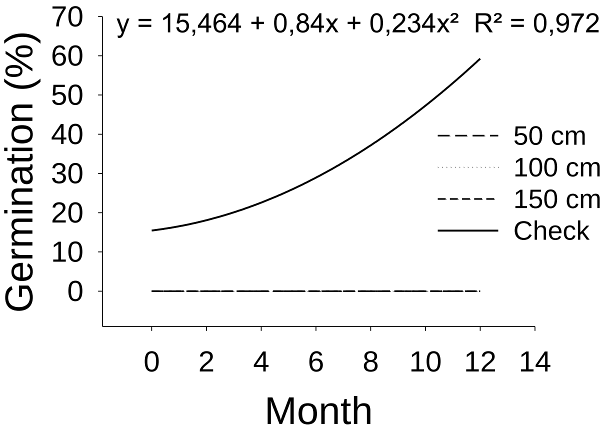
The second trial had the same design, number of treatments and replication as the first trial. Used stainless steel screen to place 50 velvet bean seeds at 50, 100 and 150 cm above soil surface, also added a check treatment that did not have contact with the burning of cane straw. After burning the cane straw, simulated the storage seed response in soil by storing them for 0, 3, 6, 9 and 12 months after burned the cane straw, then took seeds for germination test using the same methodology as the first trial.

The data from the first trial were subjected to ANOVA ($p < 0.05$), followed by Tukey ($p < 0.05$), the data from second trial were analysed using regression to understand the response of seed germination over storage period. All statistical analysis used sotware R 3.3.3 and graphics SigmaPlot 11.0.

RESULTS

The burning of cane straw had a significant effect on seed germination from the firts trail (Figure 1). The seeds over the cane straw and on soil surface were significantly different from seeds at 2 and 5 cm deep, yet different from the check treatment as well. Velvet bean seed that were 2 and 5 cm up to soil surface and the check treatment had a percentage of germination statistically the same (Figure 1). Seeds at 50, 100 and 150 cm up to soil surface on the second trial (Figure 1), did not germinate in any storage timing, although seeds from the check treatment germinated in all storage timing. Also, the check treatment showed an increase on the percentage of germination as the storage timing increases (Figure 1).





Graphic 1. (Left) Percentage of seed germination from the first trial: T1 – seeds at soils surface; T2 – seeds over cane straw; T3 – seeds at 2 cm deep; T4 – seeds at 5 cm deep; T5 – check treatments. (Right) Percentage of seed germination influenced by storage timing from the second trial.

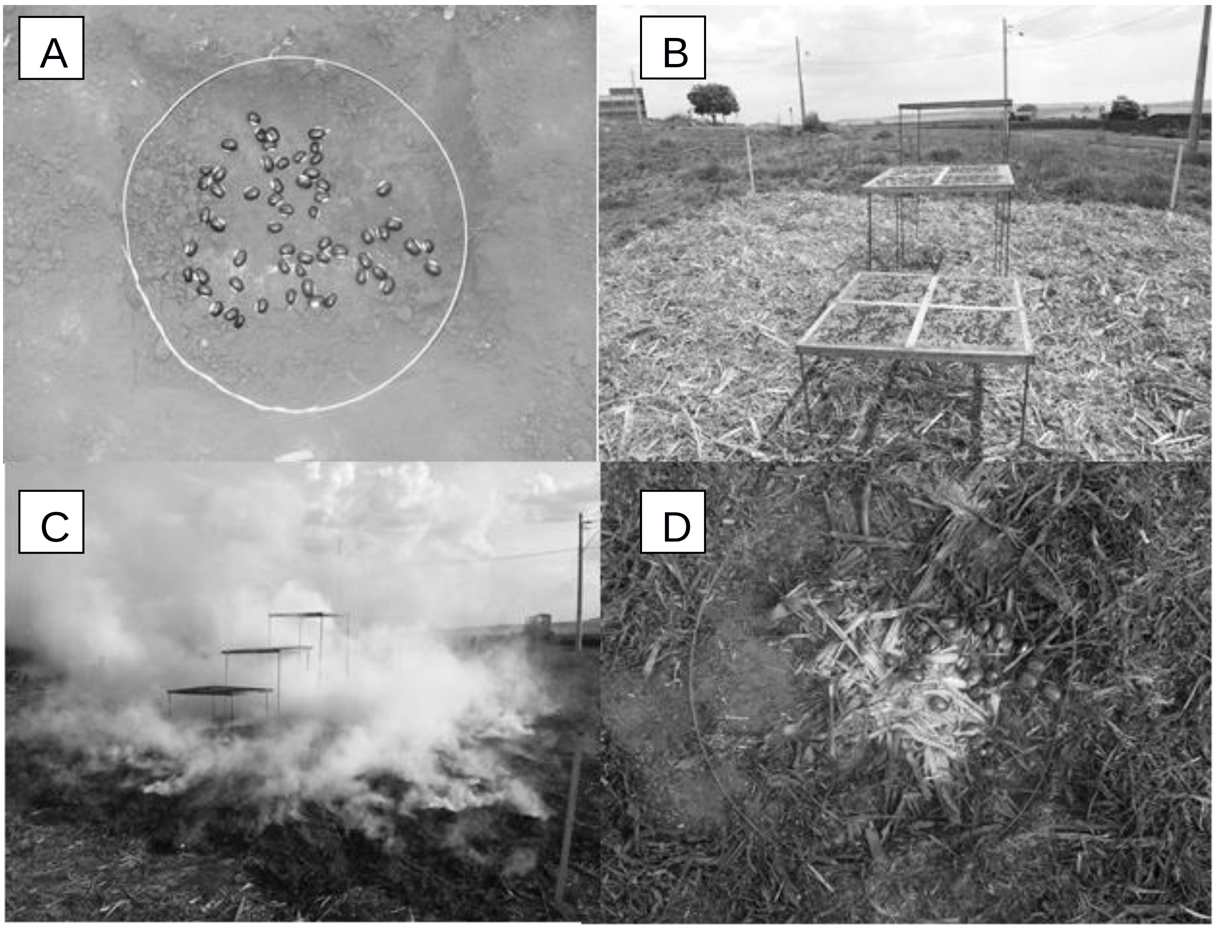


Figure 1. Illustration from the simulation of the burning cane straw: (A) Seeds at 2 cm deep from the soil surface; (B) Seeds laid over the stainless steel screens at 50, 100 and 150 cm above soil surface; (C) Simulation of burning cane crop; (D) Seeds after the burning of cane straw at soil surface.

DISCUSSION

Results from the first trial might be related to the breaking of testa due to burning of cane straw, then brake the dormancy and stimulate the germination. Paula; Pausas (2008) evaluating the seed response of annual, perennial and tree species from Mediterranean ecosystem, they concluded that perennial seeds had more tolerance to fire and heat than annuals. Luna et al. (2008) showed that most of species from the province of Cuenca increased their germination after a natural large fire. Makenzie et al. (2016) studying the seeds of *Boronia* species from Rutaceae family, showed similar characteristics of dormancy as velvet bean has, yet seeds exposed to 90 ºC of heat, had a dormancy broken. Plants from a bush community on the Mediterranean ecosystem, after a natural fire showed a stimulation on germination (CARRINGTON; KEELY, 1999). Also, most of species from Fabaceae family on the Sydney Basin showed a stimulation on germination due to fire (OOI et al., 2014).

The increase of germination on check treatment influenced by storage timing from the second trial, indicate that seeds remained on the soil at 2 or 5 cm deep can become a troublesome weed for the next harvesting. The dormancy can be influenced even after the burning of a sugarcane field because seeds might face unfavorable climate and germination begins later with better climate (THOMPSON et al., 2003). Also, the physiology of seed dormancy can be influenced even after the burning of a sugarcane field, because seeds might face undesirable climate then germination will start only with a better climate conditions (BASKIN; BASKIN, 2014). Maciel et al. (2010) studying the break of dormancy in velvet bean seeds, stated that seeds with rupture testa had 100% of germination. Kabori et al. (2013) studying methods to break dormancy of velvet bean seeds, showed a low percentage of germination in seeds subjected to dry heat. Souza et al. (2015) studying the response of velvet bean intact seeds to storage period, concluded that long periods might increase the germination. Therefore, velvet bean seeds after the burning of sugarcane field that remained under the cane straw might germinate in a good climate conditions, yet might become a troublesome weed to next crops due to its response of storage timing.

CONCLUSION

The heat and fog from the burning of sugarcane field can inhibit germination from seeds that are on soil surface even at 150 cm up to soil surface.

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