IJIRR

International Journal of Information Research and Review
Vol. 04, Issue, 01, pp.3545-3548, January, 2017

Research Article

EFFECTS OF REPETITIVE CUTTINGS OF THE STEM ON THE GROWTH OF TYPHA AUSTRALIS (SCHUM. & THONN.)

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ARTICLE INFO

Article History:

Received 14th October, 2016
Received in revised form
22nd November, 2016
Accepted 25th December, 2016
Published online January, 30th 2017

Keywords:

Typha,
Cutting Frequencies,
Aerial Parts,
Underground Parts,
Rhizome.

ABSTRACT

Responses of Typha australis (Schum. & Thonn.) to repetitive cuttings of the stem has been tested in this work. Seedlings were harvested by pulling in the Niayes area. After reduction of the rhizome length and plant height, they were transplanted into containers filled with sand of defined characteristics. The plants were acclimated to limit the stress due to uprooting and transplantation. They were divided into 3 lots of 3 replications: a first control group, a second lot cut every 7 days and a third lot cut every 15 days. A decrease of the height and the number of leaves is observed following repetitive sections with regard to control plants with significant differences. At harvest, fresh matters of aerial parts and dry matters of underground parts are reduced with the cuttings made in different periods compared to control plants. There was no significant difference between the cuttings realized every 7 and every 15 days. The mass rhizome is further reduced and reserves increasingly mobilized when the cuttings are frequent with significant differences. The repetitive cuttings on the stem had a reducing effect on the growth of cattails. They could give a promising approach for the management of this invasive plant.

INTRODUCTION

The proliferation of Typha is possible through two modes of reproduction being able to be simultaneously: a sexual reproduction from the flower by seeds and vegetative propagation assured by rhizomes. The expansion of the species is made in a vertiginous speed and is disproportionate. Which results in resistance to environment and causing enormous problems for people with ecological, socioeconomic and health (Diagne et al., 2010). Typha australis so establishes a real brain teaser for people. The management of these types of invasive plants often aims to eradicate and / or slow down their development. Their control is now essentially mechanically and sometimes chemically without convincing results (Helsteen et al., 1999; Bimova et al., 2001; Weston et al., 2005). Trials carried out with the same experimental conditions showed that cut once made on the stems stimulates the development of the underground system, which increases the growth of the plant (Kane et al., 2015). Repetitive cuttings realized on the stem, almost nonexistent, could be a way for an effective control of the species.

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What is the response strategy proposed by *Typha australis* following these types of disturbance? The effect of repetitive cuttings at different time intervals on the stem was tested in this work.

MATERIALS AND METHODS

Growth conditions

The trial was conducted in Dakar 14°41'North latitude and 17°26' West longitude. 30 plastic containers in the shape of cylinders of 30 cm high and 50 cm in diameter, filled with sand dunes whose characteristics are defined (Ndiaye *et al*., 2012) were used. *Typha australis* seedlings, having substantially the same age, were collected by uprooting, taking care to preserve the entire rhizome in the "Niayes" agro ecological area characterized by depressions and sand dunes based on a shallow water surface. The plants are cut to 10 cm and rhizomes reduced to the same size. They are transplanted into containers and abundantly watered. This hydric status is maintained during all the duration of the experiment. After a period of acclimatization of 10 days to avoid stress due to uprooting and transplanting, a second cutting is realized at 10 cm from the ground.

The plants were divided into 3 groups of 3 replications: a control group not subjected to cutting, a second lot for which the cuttings are realized on the stem at 10 cm above the ground all 7days and a third lot for which cuttings are realized every 15 days.

Measurements

Aerial parts

Height and leaf number of the plants are estimated by the 45^{th} at the 108^{th} days after transplantation. Fresh matters from the aerial parts of the second and third lots are measured immediately after the cuttings with a precision balance. After drying it in an oven for 72 hours at 70 ° C, the dry matter is determined.

Underground parts

The harvest of the underground parts that contain root mass and rhizome mass, was performed by cutting the container in the direction of height to release the clod. It was placed on a fine mesh screen. The emission of a jet of water collects underground parts (Kane et al., 2004). The roots are separated from the rhizome. After drying in an oven at 70 ° C for 72h, dry matters are estimated with a precision balance.

Statistical analysis

The comparison of control plants and cut plants was made from the test of Student. The significance level is 0.05. Data were analyzed by SPSS 20 (SPSS, 2012).

RESULTS

Height

The height of first lot increases the 45th to 73th DAT of 55.6 to 90 cm then virtually held there until the end of the experiment. For the plants of second and third lots, the height decreases substantially with the same tendency from 57 cm to 19 cm on average without significant differences (Fig. 1).

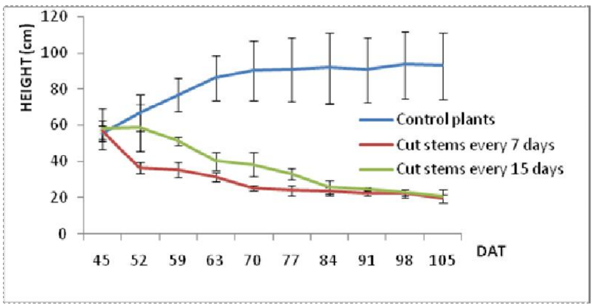

Fig. 1. Evolution of height of the control plants and these under cuttings by the number of days after transplantation (DAT). ($F = 23{,}326$, $df = 89$, $p < 0.05$)

Number of leaves

For the control plants, number of leaves goes by an average from 5.6 to 12.3 from the 45^{th} day to 105^{th} day after transplantation. The plants for which the cutting was done every 7 days, the number of leaves increases from 5.6 to 9 at 70 DAT and decreases at the end of the experiment with an average of 4.

For the plants having cuttings by interval of 15 days, the leaves production evolves from 5.3 to 7.3 until 63^{th} DAT then reduces by an average of 5 at the end of the experiment (Fig.2).

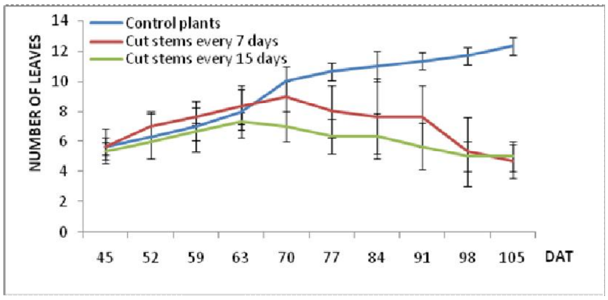

Fig. 2. Evolution of numbers of leaves of the control plants and these under cuttings by the number of days after transplantation (DAT) ($F = 114.24$, $df= 89$, $p<0.05$)

Fresh matters of aerial parts

The fresh matters of second lot decrease from 8.7 to 3 g on average between the 45^{th} and the 52^{th} DAT until the 66^{th}; from the 73^{rd} DAT, a second drop is observed. The fresh matters fall practically to 1 g until the end of experiment (Fig. 3). For the 3^{rd} lot, the mass of matters decreases from 6.6 to 2.9 from 52^{th} to 108^{th} DAT.

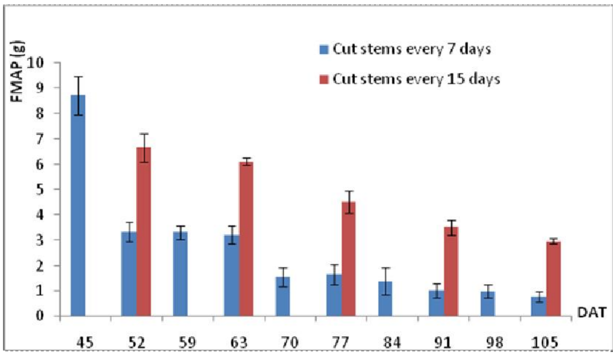

Fig. 3 Fresh matters of aerial parts (FMAP) of cut stems every 7 and 15 days by the days of transplanting (DAT)

At harvest (Fig.4), the fresh matters produced by the cut plants of the 2 lots are nearly the same: 30g on average against 58 g for control plants with significant differences.

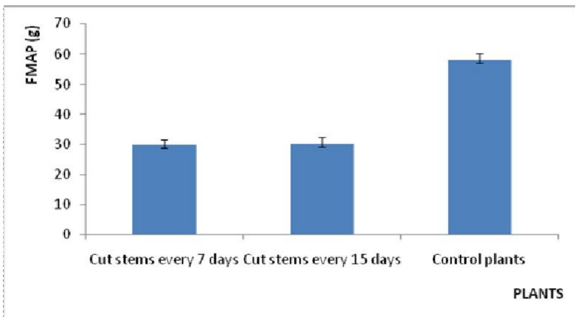

Fig. 4. Fresh matters of aerial parts (FMAP) of cut and control plants at the end of experiment. ($F=159.55$; $df=8$; $p<0.05$

Dry matters of aerial parts

The dry matters (Fig. 5) decrease from 45^{th} to 108^{th} DAT for the plants of 2^{nd} lot from 1.13 to 0.1 g and from 1.16 to 0.4g for the 3rd lot with significant differences.

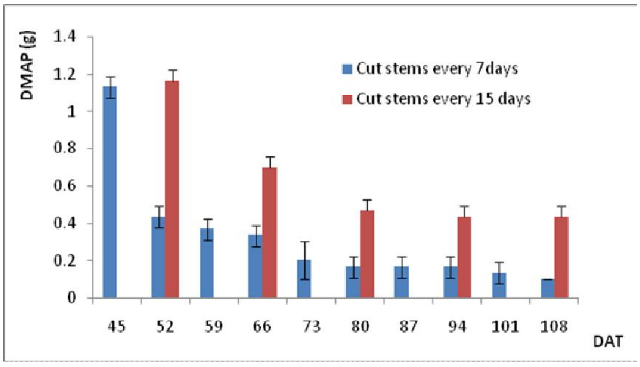

Fig 5. Evolution of dry matters of the aerial parts (DMAP) of cut stems by the number of days after transplantation (DAT). ($F=0.412$; $t=-3.270$; $df=43$; $p<0.05$)

The dry matters at harvest (Fig. 6) show that the production is fairly similar in cut plants. They are respectively 3.4g and 3.9g and remain lower than those of control plants that have a product of 8.4g.

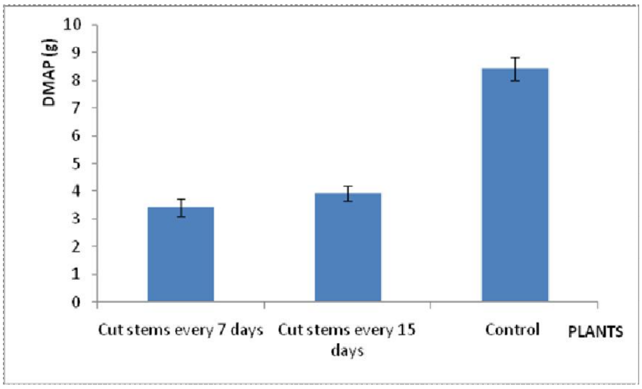

Fig 6. Dry matters of aerial parts (DMAP) at the harvest of cut and control plants

Dry matters of undergrounds parts

The dry matters of control plants is more important than cut plants: it is 16.9g while for the 2nd and 3rd lots there are respectively 4.5g and 10.6g (Fig.7).

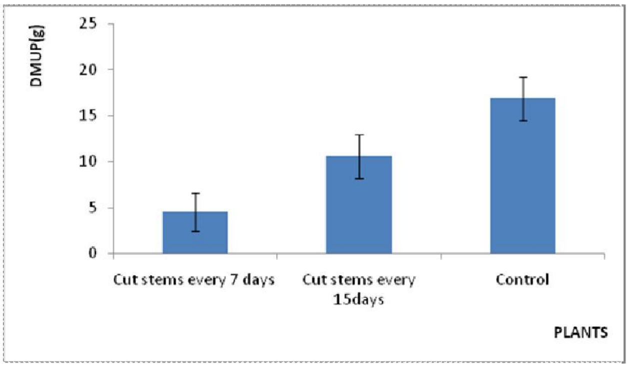

Fig. 7. Dry matters of undergrounds parts (DMUP) at the harvest of cut and control plants

Distribution of matters in the undergrounds parts of plants

At harvest, the root mass decreases in the 2nd lot and the third lot from 9.6g to 4.2g. In control plants the mass is 13.8g.

The mass rhizome in control plants is 3g. It decreases from 1g to 0.2g when the cutting is done every 15 days and 7 days (Fig.8).

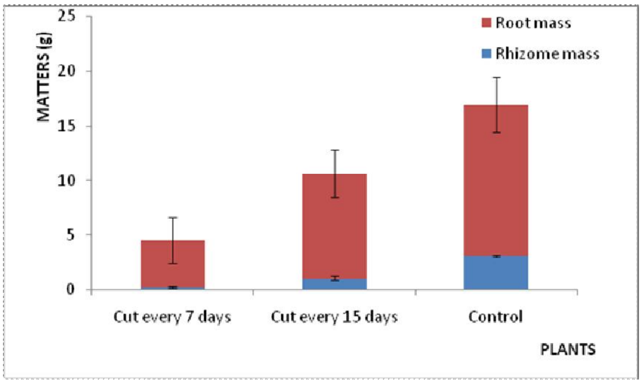

Fig.8 .Distribution of dry matters rhizome and root in controls plants and subject to cuttings

Ratio rhizome/dry matters aerial parts is 0.35 in control plants. It decreases from 0.25 to 0.05 when the cuts are made every 7 days and every 15days. Ratio rhizome/root mass follows the same trend with values of 0.21 for the control plants and 0.10 and 0.04 respectively when the cuts are made every 7 days and 15 days.

DISCUSSION

Repetitive cuttings cause a negative effect on the height, number of leaves, compared to control plants. There are also fresh and dry matters of the aerial parts but for these parameters they are quite similar with no significant difference regardless of frequency of the cuttings. Walter (2006) on *Rhizophora mucronata* and Ziudam and PETEERS (2012) on *Potamogeton lucens* L. and *P. compressus* show that the cuttings made at different levels affect the growth and biomass. At the harvest, dry matters of underground parts are even lower than the frequency of cuttings is high. These results are consistent with those of Hatase et al. (2010).and Saito and Okubo (2012) who show that cutting frequencies are performed to an invasive plant *Coreopsis lanceolata*, its growth decreases. When cuttings are made every 15 days, rhizome mass is 3 times lower compared to control plants. It is 15 times lower if they are performed every 7 days. This results in a decrease of the ratio rhizome mass / aerial parts and the ratio rhizome / root mass.

The reserves contained and accumulated in the rhizome decrease for the construction of aerial and underground parts. This mobilization is all the more important that the cuttings are done frequently. As the rhizomatous plants like Typha invest a large part of their energy when conditions are unfavorable (Wiegleb et al., 1991), the decrease of rhizome mass affects the disappearance of the plant without possibility of regeneration. Indeed, the increase of rhizome mass allows the plant to better survive in hypoxic (Sharma et al., 2008). The control of *Typha* passes through by repetitive cuttings in interval of time which it will be necessary to determine. If cutting once is made on *Typha* in experiment conditions, no significant difference was observed compared to control plants (Kane et al., 2015). It even increases the growth of *Coreopsis lanceolata* (Saito and Okubo, 2012). Although the experiment had a limited duration and was conducted in semi-controlled conditions, repetitive cuttings could be considered to control the infestation on the one hand and optionally the production of other hand.

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