Influence of onion planting date on *Helicoverpa armigera* (Hübner) larvae population in Northern Burkina Faso

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ABSTRACT

**Objective:** Onion is the main vegetable produced in Northern Burkina Faso. Since 2005, the prices have increased over threefold leading to an increase in production areas and the number of annual cycles. The intensified production has led to invasion of the crop by *Helicoverpa armigera* (Hübner 1808) larvae, which is the main insect pest in the area. The aim of this study was to impede the invasion of *H. armigera* larvae, focusing on the effect of farming period and the locality of production.

**Methodology and results:** A survey was carried out in twenty peasants’ farms in 4 localities from September to December 2010. Data were collected by counting the larvae found on the onion fronds. The number *H. armigera* larvae revealed that the proliferation was more intense in the plantations during September as compared to December. Similarly, the average weight of the bulbs and the yields depended on the number of larvae and the date of planting. The yields were 19 t.ha⁻¹ versus 30 t.ha⁻¹ for the plantations established in September and December, respectively.

**Conclusion and application of results:** Based on the results, a month long period of dead vegetation (plants) before planting is useful to allow a reduction in the number of fertile adults of *H. armigera* after the end of the cereal cycle.

**Key words:** Burkina Faso, Onion, *Helicoverpa armigera*, larvae.

INTRODUCTION

Onion is an annual plant belonging to the family *Liliaceae* whose production is widespread in North Africa (Abdullah et al., 2005). Among all the vegetable produced in Burkina Faso, the selling price of onion is the highest (Sanon et al., 1998). This situation has brought about an infatuation for its intense cultivation by small scale farmers. The harvests of the first cycle are sold at the beginning of November. However, due to the proximity of that cycle to that of cereal production, onion plantations get infested by the majority of cereal insects such as *Helicoverpa armigera* (Hübner). This insect causes severe damage in plantations and often leads to their abandonment by the farmers (Ochou, 1999). The damages caused by the larvae of the insect are significant and can prevent proper growth if protection measures are not taken. According to Bhatt and Patel (2001) the number and pressure of insects of insects’ population varies depending on the planting date. However, the bimodal character of climate defines a dry season from October to May and a rainy
season from June to September. In these conditions, the polyphagous larvae found on cereals also attack the other host plants that can allow their survival during the dry season (Nibouche, 1994). Larvae incidence is high since the cycles are close to one another (King and Coleman, 1989; Martin, 2003). Therefore, this study was undertaken in order to evaluate the dynamics of *H. armigera* population on farm depending on the date and the area of transplanting and also to examine its incidence on the average weight of the bulbs produced.

**MATERIALS AND METHODS**

**Study area:** The study was carried out in the Northern region of Burkina Faso in the rural towns of Ouahigouya, Koumbri, Tikare and Yako. Most of the agroecological conditions are similar in these 4 towns. These are the main production areas of vegetables in the North of the country. The region is characterized by little rainfall requiring a strict management of water resources.

**Onion variety:** The biological material used is a variety of onion called Violet de Galmi (VDG) which is particularly adapted to the area. The seeds were provided by the company Technisem France and marketed locally by Nankosem Burkina Faso. The bulbs of this variety have an average weight varying from 80 g to 150 g each, depending on the density of the plantation.

**Data collection:** Data were collected by counting the larvae found on the onion fronds. The larvae were sampled between the 10th and the 50th day after transplantation and this occurred from 7 to 9 am each 2 days. The larvae collected were put in tubes containing 500 ml 70 % alcohol, each tube holding 20 larvae. The larvae were sorted and identified following Borchert *et al*.; (2003) and the pictorial guides of Robert *et al*., (2003) and Anonymous (2009). Additionally, 5 larvae from each area were put in breeding in a mosquito’s web to see the stage of adults. One month old adults obtained from this breeding were identified according to Borchert *et al*.; (2003).

**RESULTS**

**Influence of the date of plantation on the number of larvae:** The planting date in each locality influenced the number of larvae of *H. armigera* (Figure 11). The number of larvae collected in September was higher in all sites than those collected respectively in October, November, and December. Although the population decreased depending on the planting date, the number of larvae remained higher on the same site comparing all dates of planting. At Yako the number of larvae was lowest for the different planting dates. The number of larvae varied across sites for a given planting date, however separation of means showed there were no significant differences for onions planted in October, November and December.
Figure 1: Evolution of the number of larvae of *Helicoverpa armigera* (Hübner, 1808) with onion planting date in four areas in Northern Burkina Faso.
Influence of larvae population on average weight of onion bulbs: The planting date influenced the number of *Helicoverpa armigera* larvae and their impact on the average weight of the harvested bulbs (figure 2). Onions planted in September had the highest average number of larvae (more than 300 larvae per site), and the average weight was less than 80 g per bulb. As the number of larvae decreased between October and December, the average weight of the bulbs increased from 80 to 120 g/bulb. Although Ouahigouya area had the highest number of collected larvae, it had the highest average weight of bulbs harvested in December when the larvae population was lowest in all areas.

![Graph showing the influence of larvae population on average weight of onion bulbs per area.]

*Figure 2:* influence of the Number of larvae on the average weight of onion bulbs per area.

Yield depending on the planting date: The date of plantation has got an influence on the yield obtained in onion bulbs. In fact, results have shown a progressive evolution of the yield as the time separating the date of transplantation from the harvesting period of cereal was long (from September to December). So we found that plantations made in September had a low yield compared to those of October, November and December. However, for a given period of plantation, they were differences between sites. The highest yield was obtained at Ouahigouya for onions planted in December (30 t.ha\(^{-1}\)) while yako site had the least yield of 25 t.ha\(^{-1}\). For planting in September, the lowest yields were 18 t.ha\(^{-1}\) at Ouahigouya and Koumbri and 17 t.ha\(^{-1}\) at Tikare and Yako.
DISCUSSION

The results of this study confirmed the importance of the period between the end of the cereal cycle and onion plantation in the different study sites as reported by Bouchard et al. (1992). This time of planting determines the density of the adult numbers that are able to lay eggs when onion plants are grown at the end of the cereal cycle or later on (Nibouche, 1994). *H. armigera* breed on the stalk of cereal during the rainy season but at the end of the life cycle of cereals, the adults of *H. armigera* fall onto other plants for their survival (Bruno et al., 2000). Otherwise, out of the stages of diapause, the adults and intermediary larvae die. This explains the decreasing number of larvae for the plantations established from October to December, which contrasts sharply to the high larvae population on onions planted in September.

The high density of larvae on the September crop could justify the abandonment of onion farms in the second
cycle after the end of the early cycle that starts in September. On second cycle farms, the number of adults is high and can cause substantial damages if prevention measures are not available. However, in the area where there was dead vegetation one month before onion planting (from October to December), only few larvae were observed. According to the results, the decrease of the average weight doesn’t only depend on the number of larvae, although that seems to be a decisive factor (Abdullah et al., 2005). At Ouahigouya where the highest density of larvae was observed during the month of September, the average weight of bulbs was highest. These observations show there are other factors aside from *H. armigera*, that affect onion bulb yield (Lediambo et al.; 1992; Martin, 2003).

For the onions planted from October to December, onion seeds initiate the bulbing during the cold period. That could also justify the variation in average weight of bulbs with different planting dates (Sanon 1999; Mermoud et al. 2005). Also, the socio-economic conditions of the producer and farm quality factors, e.g. soil fertility could also influence the average weight of bulbs (Sanon et al. 1998). The producers possessing animals use mineral fertilizer and manure to improve soil fertility.

**CONCLUSION**

The yield obtained in September and December shows that the pressure of the insects combined to the season of production influences the yield of onion. For effective protection by pest avoidance (without use of insecticide) it is advisable to plant onions in November. However, plantations established in September and October requires other mean of protection. Our results support the conclusion that in absence of any insecticide treatment, it is important to observe a period of dead vegetation at the end of the rainy season before the establishment of onion farms (Martin et al., 2003).

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