Journal of Applied Biosciences 46: 3113– 3119

ISSN 1997–5902

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

SORO Senan[1, 2*], DOUMBIA Mamadou[1], YEBOUE N'guessan Lucie[1], DAO Daouda[2, 3] and TANO Yao[3]

[1] Université d'ABOBO-ADJAME Abidjan, UFR des Sciences de la Nature, 02 BP 801 Abidjan 02, Côte d'Ivoire ; [2] Centre Suisse de Recherches Scientifiques en Côte d'Ivoire. 01 BP 1303 Abidjan 01; [3] Université de COCODY-ABIDJAN, 22 BP 582 Abidjan 22

*Corresponding author email: senan.soro@csrs.ci ; Tél (00225) 03488913 ou /03589652
Original Submitted In 5th August 2011. Published online at www.biosciences.elewa.org on October 28, 2011.

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 2010Data 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 us *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 where 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).

The farms were established at the end of cereal cycle in localities where no onion was previously cultivated. At each locality, 20 farms of 1000 m^2 were created by a group of 20 producers. The nursery were made in a closed environment (under an insect screening fabric) to avoid early contamination of seedlings before their transplantation. After the transplantation of the plants, no insecticide was applied in order to allow better evolution of larvae and the laying of eggs by the adult insects. The seedlings were transplanted on planks comprising each 6 to 8 lines of 25 meters long and 1 meter wide. That is a density of 1500 to 2000 plants per plank The irrigation system was the FDS™ (Family Drip System) developed by the company Netafim Inc (www.netafim.com). Each unit of the system (kit) ensures irrigation on a surface of 500 m^2. It comprises of a principal ramp (flexible hose) of 25 meters long and 26 centimeter diameter. A secondary ramp of 6.4 millimeter diameter with emitters is incorporated (1.9 $l.h^{-1}$ of flow). A group of accessories composed of a filter, sluice gate, bends and connecter were part of each unit. After transplantation, plants were irrigated once a day in the morning until the 85th day.

Data analysis: The statistical analyses have been made according to the GLM model with the SAS 8.2 Software. The averages have been estimated to the point of 5 %, followed by the Duncan test for the classifications.

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

.

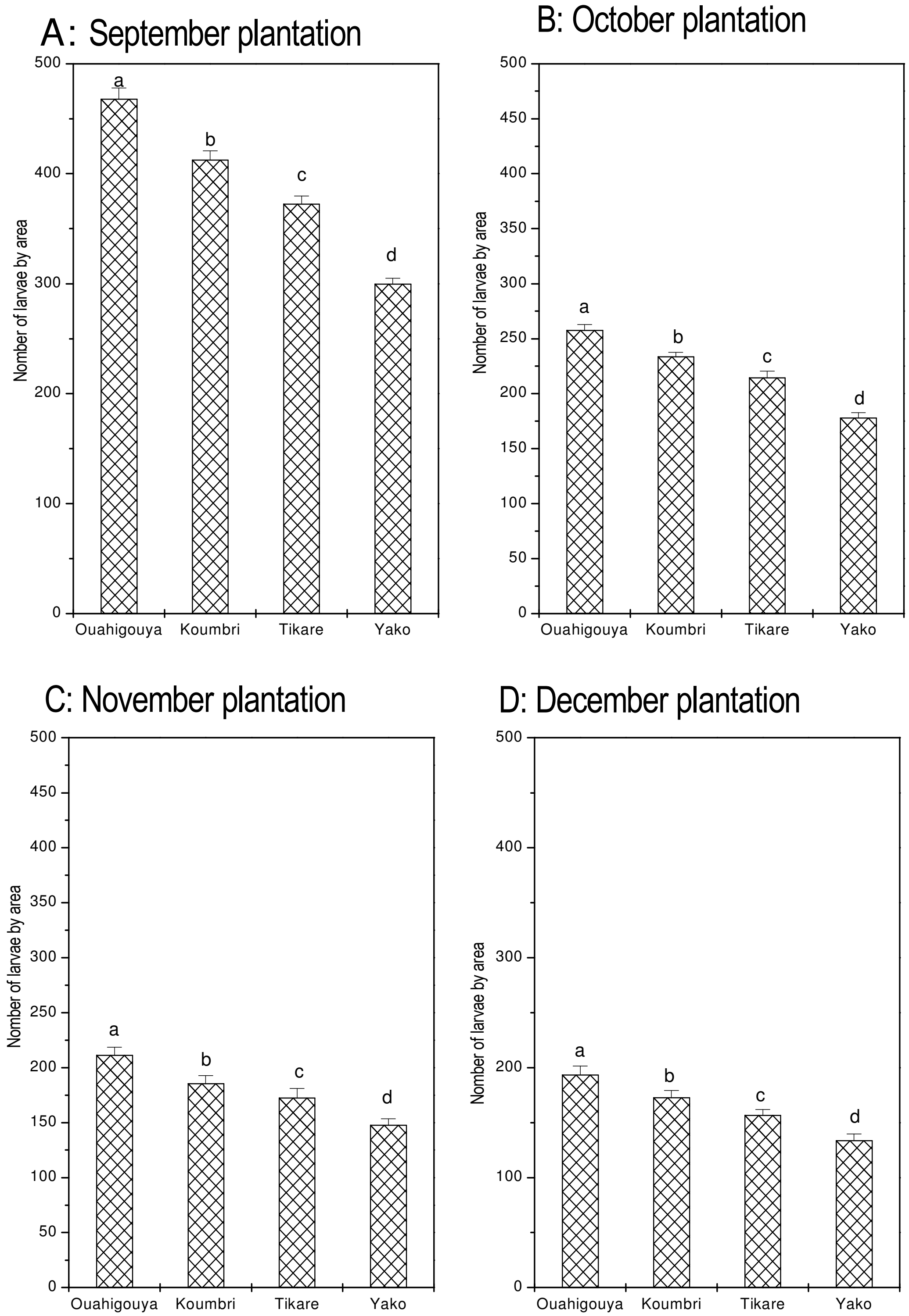

Figure 1: Evolution of the number of larvae of *Helicoverpa armigera* (Hübner, 1808) with onion planting date in four areas in Northern Burkina Faso.

Influence of larvae population on average weight of onion bulbs: The planting date influenced the number of *H. amigera* 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 larva 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.

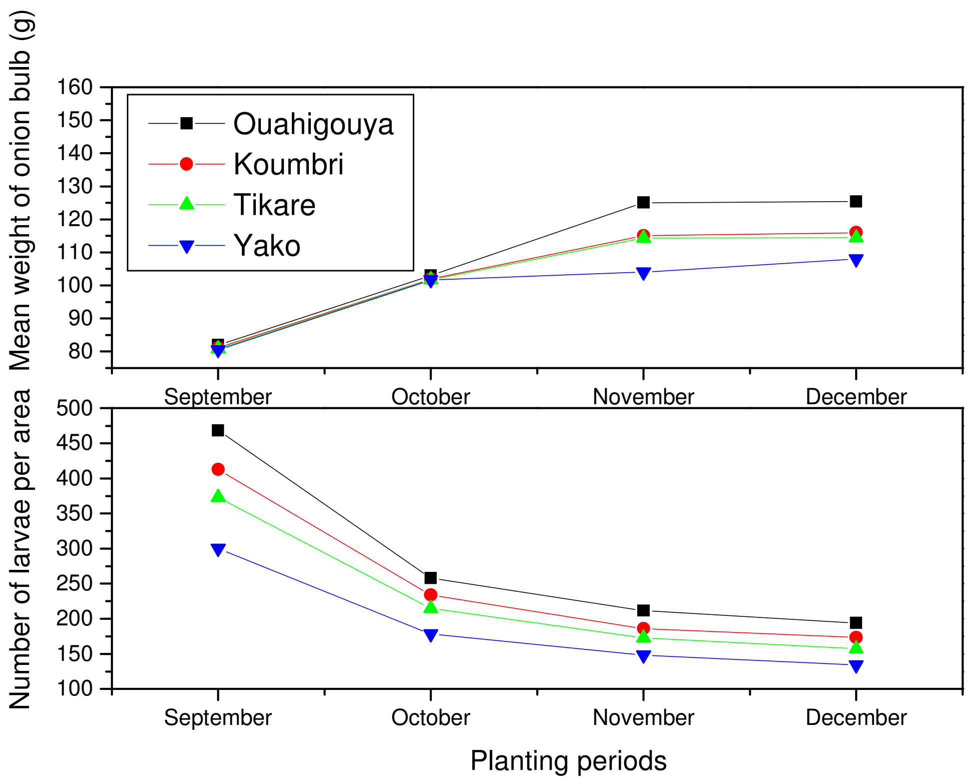

Figure 2: influence of the Number of larvae on the average weight of onion bulbs per area.

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

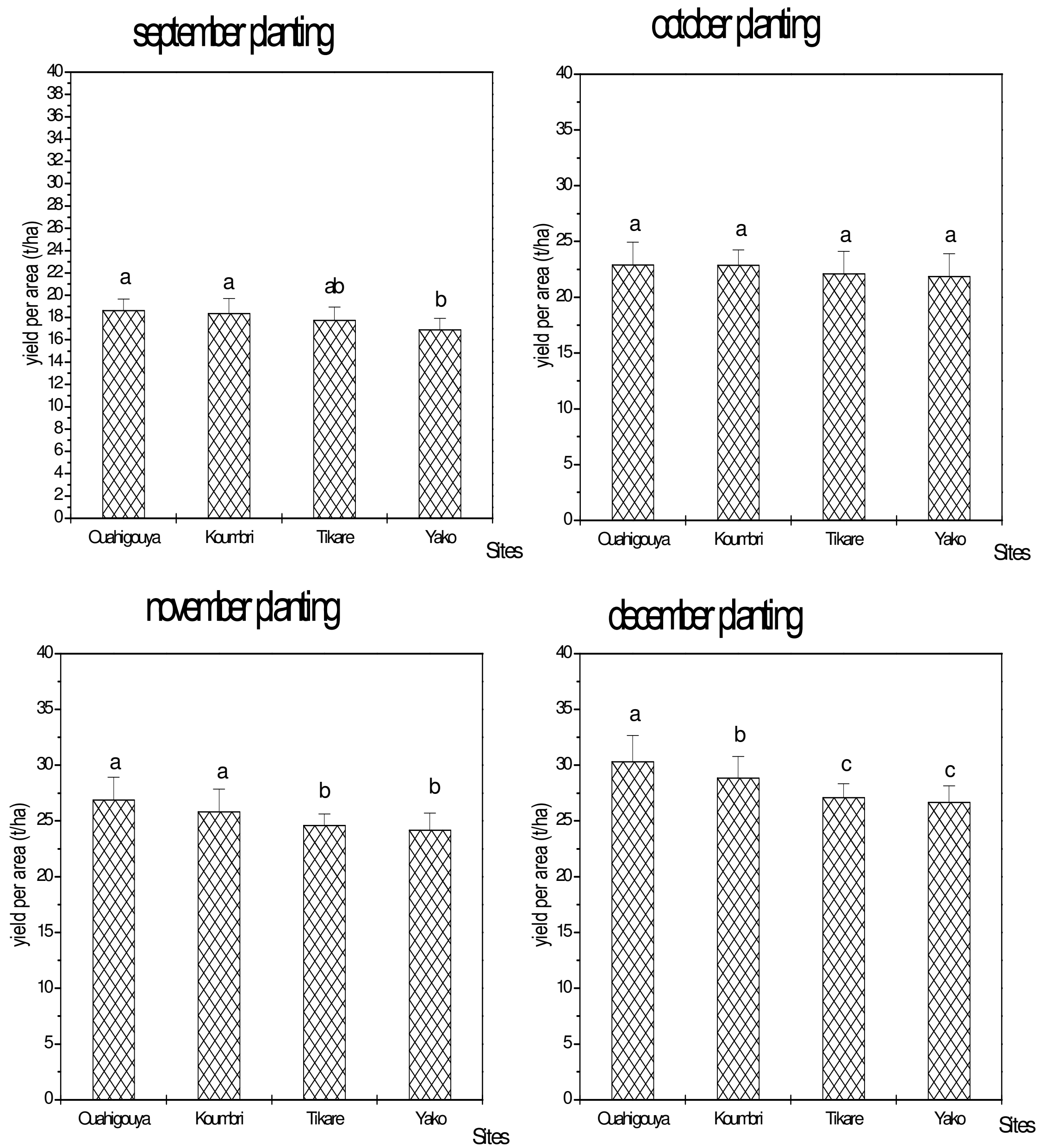

Figure 4: Average yield of onion bulbs in ($t.ha^{-1}$) per site depending on the transplanting date.

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 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).

ACKNOWLEDGEMENTS

We express our gratitude to the DDC (Swiss Agency for Development and Cooperation) in Burkina Faso and the Swiss Center for Scientific Research (CSRS) in Cote d'Ivoire
.

REFERENCES

Abdullah k, Gokhan IT, Yusuf U., Belgin C: 2005. Crop water use of onion (*Allium cepa* L.) in Turkey. Agricultural water management (72): 59-68.

Bruno M, Mamoutou T, Téréta I., Traoré NN : 2000. La lutte contre les ravageurs du cotonnier au Mali : Problématique et évolution récente. Cahier d'Agriculture 9 (2) : 109-115.

Anonyme : 2004. Le Cadre Stratégique de Lutte contre la Pauvreté (CSLP). Ministère de l'Agriculture, de l'Hydraulique et des Ressources Halieutiques. République du Burkina Faso, 267 p.

Bhatt NJ. and Patel RK: 2001. Biology of chickpea pod borer, *Helicoverpa armigera*. Indian Journal of Entomology, 63 (3): 255-259.

Borchert DM, Magarey RD., Fowler GA: 2003. Pest assessment: old world bollworm *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae). NAPPFAST, USDA-APHIS-PPQ-CPHST-PERAL/NCSU, 27 mai, (1): 1-9.

Bouchard D, Ouedraogo A., Boivins G: 1992. Vertical distribution, special dispersion and sequential sampling plan for fruit damage by *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) on tomato crop in Burkina Faso. Tropical Pest Management 38: 250-253.

King FG. and Coleman RJ : 1989. Potential for Biological control of *Heliothis* species. Annual Review of Entomology-34: 53-75.

Lediambo B, Yagoua D, Renou A., Martin T : 1992. Perspectives nouvelles pour la protection des cultures de Niébé au Tchad. Revue Scientifique du Tchad, 2 (1-2) : 163-168.

Martin T : 2003. La résistance aux insecticides de *Helicoverpa armigera* en Afrique de l'Ouest, du mécanisme à la gestion. Montpellier, CIRAD, Thèse de doctorat d'Université 60 p.

Martin T, Ochou O.G, Vaissayre M., Fournier D : 2003. Organophosphorus in insecticides synergizes pyrethroids in the resistant strain of cotton bollworm, *Helicoverpa armigera* (Lepidoptera, Noctuidae) from West Africa. Journal of economic entomology, 96 (2): 468-475.

Mermoud A, Tamini TD., Yacouba H : 2005. Impact of different irrigation schedules on the water balance components of an onion crop in a semi-arid zone. Agricultural water management (77): 282-295.

Nibouche S : 1994. Cycle évolutif de *Helicoverpa armigera* (Hübner 1808) (Lépidoptère Noctuidé) dans l'Ouest du Burkina Faso : Biologie, Ecologie et variabilité géographique de populations. ENSA Montpellier, France, Thèse de doctorat n° 94NSAM0025, 148 p.

Ochou GO, Koffi DN, Martin T, Hala N'Klo F., Niéré K : 1999. Projet régional Afrique de l'Ouest ; Prévention et gestion de la résistance de *H armigera* aux Pyrethroids in : Projet régional Afrique de l'Ouest, 1999-03-17/1999-03-19, Bobodioulasso, Burkina Faso, 1-5.

Robert CV, Erica ED, Jennifer Z, Holly H., Margaret L: 2003. Mini risk assessment old world bollworm, *Helicoverpa armigera* Hübner (Lepidoptera: Noctuidae). Department of Entomology, University of Minnesota, St. Paul, MN 55108, 36 p.

Sanon, M : 1999. Optimisation de l'irrigation à la parcelle par radio thermométrie. Application à une culture d'oignon en climat sahélien (Nord ouest du Burkina Faso). Ph.D. Thèse, ENSA Rennes. 294 p.

Sanon, M, Rouamba, A, Nicolas H., Baldy C: 1998. Importance socio-économique de la production d'oignon en Afrique de l'Ouest: contraintes et perspectives. Cahiers Secheresse 9, 233–238.

Vaissayre M, Martin T, Prudent P., Vassal JM : 1999. Prévenir et gérer la résistance des insectes aux pesticides, le cas de la noctuelle *Helicoverpa armigera*. Agriculture et développement (22) : 82-87.