Management Information on *Rottboellia cochinchinensis*

Mechanical: NAPPO (2003) states that, "*R. cochinchinensis* in East Africa is controlled by a combination of cultivation followed by fallowing for at least 2 years. The infested site is first burned to destroy the seeds on the surface. Next, it is ploughed to stimulate germination of seeds in the top soil horizon. Following this, deep ploughing is done to bury the seedlings. After this, the land is left fallow until the buried seeds expire and the land is considered clean (Holm *et al.* 1997)."

Chemical: Strahan *et al.* (2000b) state that, " Soil-applied herbicides metolachlor, EPTC, and atrazine do not control *R. cochinchinensis*. Trifluralin and pendimethalin are effective soil-applied herbicides for *R. cochinchinensis* control in soybean and sugarcane. Pendimethalin has also been effective for controlling *R. cochinchinensis* in corn, although seed production can still occur in later-emerging plants. Similar results have been observed with dinitroaniline herbicides in soybean. *R. cochinchinensis* germination and emergence from soil depths of 15 cm probably contributes to the poor control with pre-emergence (PRE) herbicides."

Strahan *et al.* (2000b) state that, "An effective management strategy for control of *R. cochinchinensis* in corn should reduce seed germination and emergence and prevent seed production by escaped plants (Bridgemohan and Braithwaite 1989). In soybean, applications of preplant-incorporated and post herbicides combined with cultivation were necessary to reduce *R. cochinchinensis* biomass at harvest (Harger *et al.* 1982). Research has shown that soil-applied herbicides alone are not adequate for season-long control of *R. cochinchinensis* in corn, and a successful *R. cochinchinensis* management program should include post herbicide applications (Bridgemohan and Brathwaite 1989)."

Biological: Smith *et al.* (2001) state that, "Studies have also been conducted that aim to develop classical biological control for *R. cochinchinensis* using the head smut (*Sporisorium ophiuri*) (Ellison and Evans 1995), whose release has been recently approved in Costa Rica. Head smut is extremely host specific (Valverde *et al.* 1999). It is soilborne and infects *R. cochinchinensis* seedlings as they emerge, thereby causing a systemic infection that leads to seed sterility. The inflorescence of affected plants emerges covered with a mass of dark-brown teliospores that are shed back to the soil to start a new infection in the next seedling generation of *R. cochinchinensis* (Reeder *et al.* 1996). Infection with head smut is unlikely to prevent corn yield-loss due to *R. cochinchinensis* in the current crop, but it may reduce the seed rain and, thus, *R. cochinchinensis* density in subsequent crops. There is no plant-to-plant spread within a generation, as the smut infects only young seedlings."
Smith *et al.* (2001) state that, "Smith *et al.* (1997) investigated the potential of head smut for *R. cochinchinensis* control using a simple population dynamics model of *R. cochinchinensis* based on annual transition probabilities and using data gleaned from the literature. The model was used to estimate the constant annual infection rate by head smut that would be necessary for long-term control of the weed. The model predicted that if the smut was the sole control agent, an annual infection rate of about 88% would be required to reduce *R. cochinchinensis* density to 10% of that occurring in the absence of weed control. These results indicated that head smut could have a substantial effect on *R. cochinchinensis* populations in situations in which it was able to build up to produce regularly high infection rates. However, it is most likely to be effective as an addition to other control methods."

A study (Ahmad and Kadir, Undated) evaluated in the laboratory and greenhouse as a potential bioherbicide, an isolate of the indigenous fungus *Drechsclera longirostrata* was isolated from diseased itch grass in Serdang, Selangor Malaysia. The authors conclude the following "The potential of *D. longirostrata* as bioherbicide for controlling itch grass was confirmed in the repeated greenhouse trials. The ability of *D. longirostrata* to induce severe infection within 24 hrs after inoculation provide supporting evidence that this pathogen has the potential to be developed as a bioherbicide. The symptoms which include burnt-like appearance of the infected leaves and the speed of plant killed indicated that phytotoxins maybe involved, as most of the species in the *Helminthosporium* group were reported to produce phytotoxins and were important in plant pathogenesis (Walton and Panaccione, 1993). Although this pathogen is not capable of killing older plants, its ability to reduce biomass of this weed is enough to reduce its population."

<u>Integrated management</u>: Smith *et al.* (2001) state that, "Research in Costa Rica has shown that effective *R. cochinchinensis* management can be based on (1) integration of the appropriate use of pre- and postemergence herbicides and (2) the planting of velvetbean as a cover crop to suppress the weed. These methods are combined with zero tillage and fallow control between crops by slashing and removing dead *R. cochinchinensis* plants after crop harvest (de la Cruz *et al.* 1994 ; Rojas *et al.* 1993b ; Valverde *et al.* 1995 , 1999)". The cover crop is usually slashed before corn harvest, resulting in the creation of a mulch that suppresses weeds in the rotational crop. This practice also prevents velvetbean volunteers but limits seed production for further plantings. Therefore, growers set aside areas to harvest velvetbean seed or allow the cover crop to complete its cycle during the fallow period. The authors state that, "In field trials with velvetbean as a cover crop, Valverde *et al.* (1995) found that the cover crop reduced *R. cochinchinensis* seed germination rate, seedling survival, and plant size."

Smith *et al.* (2001) state that, "Corn growers in the Guanacaste region control *R. cochinchinensis* mainly by a combination of manual (slashing) and chemical methods. Two-thirds of the growers use the contact, non-residual herbicide, paraquat. Some farmers spray more than twice during the cropping season, because lack of soil activity prevents paraquat from controlling seedlings germinating after herbicide application (Valverde *et al.* 1999). Alternatively, pendimethalin has been included as a chemical option within the integrated management of *R. cochinchinensis*. Pendimethalin is less toxic than paraquat, is selective to velvetbean and corn when applied preemergence, and has limited residual activity, thereby providing better control at crop establishment with a single application. When adequate light and moisture are available, an additional proportion (g2) of seeds will germinate and emerge after the pendamethalin ceases to be active, resulting in a second emergence of seedlings (Ni2,t). *R. cochinchinensis* can produce up to five such seedling emergences of decreasing importance each season, which, based on our field observations, can be reduced to two when velvetbean is planted to suppress the weed. "Escapes" from the herbicide can also contribute to the seed bank if they are not controlled by other means."