ENHANCING FOOD SECURITY IN NIGERIA THROUGH INTEGRATED WEED MANAGEMENT

FALADE, A. A. & LABAEKA, A.
Department of Agricultural Education,
Federal college of Education (Technical), Akoka,
Lagos, Nigeria.
Corresponding author's e-mail: aafalade@yahoo.com

Abstract
Weed is a limiting factor to crop production and thus, the attainment of food security in Nigeria. Uncontrolled weed growth in maize in Nigeria caused 18-60% yield loss; 51% in Sorghum, 28-100% in rice, 48-90% in cassava, 70-91% in yam, 35-83% in cowpea, 40-53% in soya bean, 54% in groundnut and 60% loss in wheat. Increasing weed population is caused by wrong use of herbicides, lack of skill in weed identification and correct matching of herbicides with weeds. In addition, over-reliance on herbicides apart from being costly, can be harmful to the soil and the environment. Also, manual weeding alone is becoming unpopular due to drudgery associated with it. This paper therefore recommended a safe, cheap and effective weed control option for farmers which is integrating all methods available, ranging from biological, cultural, mechanical and finally chemicals in that order of preference. This ensures a limit to the introduction and spread of weeds, helps the crops to compete with weeds and finally makes it difficult for weeds to adapt. The overall benefits to the farmer will include cost minimization, higher crop yields and safe environment for useful organisms in the crop-soil ecosystem.

Keywords: Food security, weed control, yield loss.

Introduction

Food security in Nigeria

Important aspects to be considered in food security issues include the availability of food stuff, the quality of the diet, the stability of supplies over time and space and access to food produced by the populace. The World Health Organisation (WHO, 1985) recommended an intake of between 2500 – 3400Kcal of energy per person per day. It is recommended that an individual should consume between 65-86g crude protein per day out of which 35g (or 40%) must be animal protein. While many Nigerians have energy intake that is far below the minimum recommended daily per capita intake, there is a great challenge of overcoming inadequate consumption of protein (especially animal protein), vitamins (vitamin A, C and folic acid) and minerals (iron) which may result in various deficiency symptoms (diseases).

Nigeria, blessed as it is, with abundant agro ecological resources and diversity, has become one of the largest food importers in sub-Saharan Africa (Idachaba, 2009; Emmannuel and Peter, 2012).

In Nigeria, despite all government efforts to boost food production, food security still remains a major problem. For instance, although agriculture remains a key component of the Nigerian economy contributing about 41% of GDP and employing about 70% of the active population, it receives less than 10% of the annual budgetary allocations. As a result, the agricultural sector has significantly underperformed given its vast potential. Consequently, Nigerian agriculture has failed to supply sufficient food in quantity and quality to feed the constantly growing population (Ojo and Adebayo,2012).

A number of factors that are responsible for the precarious food insecurity in Africa and Nigeria in particular are: low agricultural productivity, lack of agricultural policies, poor infrastructure and high – transport costs, lack of appropriate marketing strategies, frequent extreme weather events, high – disease burden including HIV/AIDS, weak financial support systems, lack of safety net systems and political conflicts. (Menghestab Haile, 2005; Ojo and Adebayo, 2012)

However, uncontrolled weed growth also poses serious challenge to abundant food production in Nigeria.

Weed problem and food security in Nigeria

Because weeds do not strike as violently as insects, there is a tendency to underestimate their economic importance. Even when a farmer is forced to abandon a crop to weeds, such incidents do not attract attention. Consequently, the lowest priority is assigned to weed science research in Nigeria. One of the reasons for lack of interest in weed control has been a gross underestimation of the fragile nature of the labour force (Akobundu, 1987).

Weeding is seen as women's work of little importance and does not receive priority attention. In Africa, weeds are accepted as the natural consequences of crop production efforts and little thought is given to improving their control (Akobundu, 1980). He also noted that: (i) weeds as crop pests are largely taken for granted and their biology is poorly understood, (ii) weed control as a science is in its infancy, and (iii) there is an absence of trained weed scientists to address weed problems in the region

Ayeni (1991) in his studies, revealed that the number one pest which farmers contend with in 25 out of 30 common crops were weed. Weeds normally compete with crops for nutrients, space, light, water, oxygen, carbon dioxide, thus reducing crop yields. Weeds need to be cleared from a field prior to planting a crop and weeds need to be removed from the field during the growing season for optimal yields to be achieved.

Weed competition is most serious when the crop is young. The critical period of crop-weed competition is approximately equal to the first one-third to one-half of the life cycle of the crop. Doll (2003) observed that the critical period is the stage after which weed growth does not affect crop yields. Keeping the crop free of weeds for the first third of its life cycle usually assures near maximum productivity. African crops have been studied at experimental farms in order to define the weed-free period required to prevent yield reduction: (weed-free period [days] required after planting) maize, 56; rice, 42; sorghum, 35; cassava, 84; cowpea, 40 (Akobundu, 1987; Ambe *et al.*, 1992).

Iyagba (2010) also noted that Cassava, Yams, Cocoyams, Irish potatoes and a host of other root crops have a slow rate of initial growth and this makes them poor weed competitors and susceptible to severe weed competition at their early stages of growth. Weeds which emerge

during the first three months after planting are known to endanger yields more than those appearing later. It has been shown that the most damaging effect on yield was weed competition with Cassava plants during canopy formation and early tuberization (third month after planting) and less from the 4th month until harvest (Onochie, 1975).

In Nigeria, the table below shows percentage loses recorded in some selected food crops due to weed infestation

Table A: Crop losses due to weeds in selected food and cash crops in Nigeria.

Crop	Percentage yield loss
Maize	18-60
Sorghum	51
Rice	28-100
Cassava	48-90
Yam	70-91
Cowpea	35-83
Soybean	40-53
Groundnut	54
Wheat	60

Source*: Oerke et al., (1994)*

In order to reduce potential crop losses, farmers spent large proportions of resources for weed management and the investment made according to Chikoye (2000) to minimize weed infestation usually exceeds those on other pests combined. Research findings revealed that in small scale production systems, which dominate Nigerian agriculture, it has been estimated that weeding alone consumes approximately 30 to 50% of total labour budget depending on the crop and the level of other available resources (Akobundu, 1991; IITA, 1987). Nkakini *et al.* (2006) reported that farmers in Rivers State utilized 43.8 man days/ha for ridging and cassava planting, 57.8 man days/ha for mound making and yam planting while general weeding used 40.0 man days/ha and root weeding using 36.7 man days/ha. The Authors further noted that farmers in the state spent energy of 317.09 MJ in weeding yam/cassava compared to 345.60 MJ per hectare for general weeding using manual labour. All these show how weeding alone consumes time and tends to limit crop production activities in Nigeria.

Common Weed Management Methods

Biological Weed Management

Biological control of weeds refers to the control or suppression of weeds by the action of one or more organisms, through natural means, or by manipulation of the weed, organism, or environment (Anon,1985). The manipulation of plant population, spatial arrangement and ground cover management have been used in root and tuber crops as biological weed control methods. Egusi melon is traditionally inter-cropped with cassava or yams.

Okeleye and Salawu (1999) have recommended the intercrop of cassava (10,000 plants/ha) and melon (30,000 plants/ha) as an effective means of controlling weeds in cassava plots. Nwagwu *et al* (2000) have also recommended the use of melon in cassava to control weeds while Zuofa *et al* (1992) suggested the use of cowpea, melon and groundnut

intercropped with cassava to suppress weeds. Iyagba (2005) reported that weeding carried out at 3 and 8 weeks after planting, in a cassava-fluted pumpkin intercrop at plant populations of 10,000 and 26,667 plants/ha respectively will produce greater cassava tuber yields and fresh leaf weight of fluted-pumpkin.

Cultural weed management

Hand weeding is the predominant weed control practice on smallholder farms (Vissoh *et al.* 2004). Hand weeding is the oldest method of weed control and consists of pulling and slashing weeds by hand and hoeing. Smallholder farmers spend 50–70% of their total labor time hand weeding (Chikoye *et al.* 2007).

About 324 hours of weeding were needed for one hectare of sorghum in Northern Nigeria (Ishaya *et al.*, 2007).

A 1998 study of women in African agriculture confirmed that weeding took up more days in the field than any other operation (IFAD, 1998). Several interviews with specialists verified that it was impossible for any one woman to keep more than a single hectare free of weeds in a typical cropping season.

Constraints in hand Weeding

Several constraints limit the effective use of hand weeding, including limited cash for hiring labor and labor not being available for hire during peak periods (Johnson, 1995).The supply of labor in rural areas has been significantly reduced in many African countries due to AIDS and migration to urban areas which has led to less weeding of crops (Bisikwa *et al.*, 1997).

AIDS is causing the loss of at least 10% of the agricultural workforce in most countries and, in at least five countries, more than 20% (Bishop-Sambrook, 2003). During the peak period, farmers have little rest. Farmers are often too sick or fatigued to complete weeding (Orr *et al.*, 2002). African women farmers have considerable family responsibilities-typically caring for six children, elderly parents and sick family members. As a result of these conflicting time demands, weeding is not always carried out in a timely fashion or in the right amounts. Malaria is also a common problem on farms, reducing the availability of productive labor. The scarcity of labor coupled with early season rains often impede timely removal of weeds

Chemical Weed control

Herbicides are an alternative to hand weeding. Herbicides can be sprayed before planting to remove weeds from a field, applied directly to soil at planting for residual control of germinating weed seeds, and applied to weeds during the growing season. Residual herbicides applied to the soil before the crop and weeds emerge from the ground remain active in controlling germinating weed until the critical period of weed competition has passed.

In sub-Saharan Africa, herbicides have been widely adopted on large plantations of cash crops such as coffee, cotton, sugarcane, cocoa and tea. Herbicides are also widely used on large government-operated farms. Faced with rising costs and scarcity of labor for hand

weeding, these plantations largely adopted herbicide technology in the 1960s and '70s (Terry, 1996)

Estate farmers have been able to use herbicide technology because they employ their own researchers and agronomists. In contrast, with less than 5% adoption, smallholder farmers in Africa generally do not use herbicides. In Uganda, herbicide use is extremely low at 0.1% of acres treated (Magyembe 1997)

Potential impacts of herbicide use

By reducing the labor required for weed control, herbicide use could allow additional resources to be invested in food crops to the benefit of food security in the region (Mavudzi *et al.* 2001).

Along with food security and better nutrition, the potential benefits of herbicide use include increased incomes and reduced drudgery. These benefits are particularly salient to women, children and the poor. A social benefit occurs when children are able to attend school because they are not needed to weed fields. Herbicide use would also release women from the toil of weeding, preventing chronic pain and spinal deformation while enabling them to pursue goals such as education

Constraints on Herbicide Use

Undoubtedly, the greatest obstacle between herbicide technology and African farmers is lack of awareness and training. Specifically, constraints involve an inadequate knowledge of which herbicide to use in a given weed-crop situation; deficiency of extension services; scarcity of trained weed science personnel; uncertainty as to the availability of herbicides; and lack of herbicides in farmer-friendly packages (Mavudzi *et al.* 2001). For herbicides to be successfully introduced, several major infrastructure systems must also be improved (Benson, 1982). The extension system, for example, depends on the competence of its agents, the frequency of their visits and demonstrations, and the credibility of their communications.

Akobundu(1980) identified the need for subject matter specialists capable of evaluating weed problems and formulating herbicide recommendations on a per country basis. Farmers in sub-Saharan Africa are still operating without this expertise. Transportation and distribution of herbicides needs to be more reliable, as farmers must apply them on time in order for them to be useful. Farmers also need access to inexpensive credit and their products must be transported to market quickly and sold at a fair price. Efforts must be made to enlighten governments on the role of weed science in the crop production equation, so as to bring governments to bear on the need for plans of action to address the problem.

Integrated Weed Management

Weed pressure is becoming more severe in new farms due to over reliance on chemical and mechanical weed control methods. Increasing weed population could also be caused by lack of availability of herbicides on the market, skill in weed identification and correct matching of herbicide to weed as earlier indicated.

In addition, over reliance on the two methods can damage soil structure and the environment. A safe, cheap and effective option for farmers could be integrating all methods

available, ranging from biological, cultural, mechanical and finally chemicals in that order of preference.

Integrated weed management (IWM) according to Akobundu (1987) "is neither a method nor a system of weed control, but a philosophy whose goal is to use all available knowledge in weed science to manage weeds that they do not cause economic loss to humans" and that a high priority in IWM is the efficient and economical use of resources while minimizing the hazard to the environment.

He also indicated that an appropriate IWM is one that economically combines two or more weed management systems at low inputs to obtain a level of weed suppression superior to that ordinarily obtained when one weed management system is used. Weeds encountered differ from one ecological zone to the other and in different farming systems in Nigeria.

IWM is more needed in root and tuber crops than in any other type of food crop (Akobundu, 1987). These crops according to the author have long growing seasons that make a dependence on herbicides inappropriate, particularly as none of these herbicides selective in yam and cassava persists in the soils at dosages that will give good weed control for more than 12 WAP.

Combining the manipulation of plant canopy (through changes in row spacing and spatial arrangement of root and tuber crops) with other methods of weed management, has been used either to reduce input levels in chemical or cultural weed control systems or to make them more effective (Akobundu, 1987).

Use of low growing crops such as fluted-pumpkin with cassava reduced the three times suggested weeding regime in cassava at 3, 8 and 12 WAP to two weeding regimes at 3 and 8 WAP by manipulating the plant population of fluted pumpkin to 26,667 plants/ha and cassava at 10,000 plants/ha (Iyagba, 2005).

Summary and Conclusion

Most Nigerian farmers depend on hand weeding and chemicals which has not solved the problem of weed infestation and re-infestation , allowing no breathing space for the farmers. Even if other inputs such as fertilizer and improved seeds are available, crop production level may not reduce the current food insecurity status as long as the hand-hoe is the primary means of weeding.

Herbicides have great potential for solving the weed problem in Nigeria because it reduces the need for labour during planting time and they are less expensive than hiring labour for weeding especially when weed competition is critical.

However, Increasing weed population is caused by wrong use of herbicides, lack of skill in weed identification and correct matching of herbicides with weeds. In addition, over-reliance on herbicides apart from being costly, can be harmful to the soil, lead to herbicide resistance in some weeds and also constitute environmental pollution. Therefore, in order to enhance food security in Nigeria and Africa at large, an integrated approach to weed management should be fully embraced by all stake holders in crop production.

References

Akobundu,1.0. (1991). Weeds in human affairs in sub-Saharan Africa: Implications for sustainable food production. Weed Tech. 5: 680-690.

Akobundu I.O. (1987). Weed Science in the tropics; Principles and Practices. A Wiley- Inter science Publications. pp. 71-105 and 364-367.

Akobundu, I. O.(1980). Weed Science Research at the International Institute of Tropical Agriculture and Research Needs in Africa. *Weed Science*. **28(4):**439-445

Ambe, J. T., A. A. Agboola, and S. K. Hahn. (1992). Studies of Weeding Frequency in Cassava in Cameroon. *Tropical Pest Management*. **38(3):**302-304.
ARPN Journal of Agricultural and Biological Science. VOL. 5, NO. 4,

Anonnymous. (1985). Terms, definitions and abbreviations. Weed Science. 33 (suppl.1) 12 – 15.

Ayeni A.O. (1991). Hand/Mechanical Weed Management as an option in Nigerian agriculture. Nigerian Journal of Weed Science. 4: 71-78.

Benson, J.M. (1982). *Weeds in Tropical Crops: Review of Abstracts on Constraints in Production Caused by Weeds in Maize, Rice, Sorghum-millet, Groundnuts and Cassava*. FAO Plant Production and Protection Paper, **32(1)**.

Bishop-Sambrook, Clare.(2003). *Labour Saving Technologies and Practices for Farming and household Activities in Eastern and Southern Africa*. IFAD & FAO.

Bisikwa, J., D. S. O. Osiru, and M. W. Ogenga-Latigo.(1997). Timing of Hoe Weeding and Herbicide Application for Competitive Weed Control in Sorghum. *16th East African Biennial Weed Science Conference Proceedings*. 205-214.

Chikoye D. (2000). Weed management in small scale production systems in Nigeria. In: Akoroda, M.O. (Ed.) Agronomy in Nigeria. pp. 153-156.

Chikoye, D., J. Ellis-Jones, C. Riches, & L. Kanyomeka. (2007). Weed management in Africa: experiences, challenges and opportunities, *XVI International Plant Congress*, pp 652–3.

Doll, J.D. (2003). Dynamics and Complexity of Weed Competition. in *Weed Management for Developing Countries*. FAO Plant Production and Protection Paper, no120 (Add.1).

Emmanuel, O.O. and Peter, F.A. (2012). Food security in Nigeria: an overview. European Journal of Sustainable Development. 1,2, 199 – 222 ISN:2239 - 5938

Idachaba, F.S. (2009). "The Looming Food Crisis", *Newswatch*, Lagos, (August 3), Special Colloquium Edition

IFAD. (1998). *Agricultural Implements used by Women Farmers in Africa*. Rome

IITA (International Institute of Tropical Agriculture) 1987. Annual Report of 1987 International Institute of Tropical Agriculture, Ibadan, Nigeria. p. 37.

Ishaya, D.B., S.A. Dadari, & J.A.Y. Shebayan.(2007). Evaluation of herbicides for weed control in sorghum (*Sorghum bicolour*) in Nigeria, *Crop Protection*, **26**, pp 1697–1701.

Iyagba A. G.(2010). A review on root and tuber crop production among small scale farmers in Nigeria. ARPN Journal of Agriculture and Biological Science. Vol.5 No 1.

Iyagba A.G. (2005). Effects of weeding regime on crop yield in Cassava/fluted pumpkin intercrop in Rivers State, Nigeria. Nigerian Journal of Horticultural Science. 10: 75-81.

Johnson, D.E. (1995). Weed management strategies for small holder rice production, *The 1995 Brighton Crop Protection Conference, Weeds*, pp 1171–80.

Magyembe, J.M. (1997). Herbicide use in Uganda, *16th East African Biennial Weed Science Conference Proceedings*, pp 165–169

Mavudzi, Z., A.B. Mashingaidze, O.A. Chivinge, J. Ellis-Jones, & C. Riches. (2001). Improving weed management in a cotton-maizesystem in the Zambezi Valley, Zimbabwe, *The 2001 Brighton Crop Protection Conference, Weeds*, pp 169–74.

Menghestab, H. (2005). Weather patterns, food security and humanitarian response in sub – saharan Africa in philosophical transactions. Biological sciences,Vol.360, No1463, published on line by the Royal society.

Nkakini S.O., Ayotamuno M.J., Ogaji S.O. T. and Probert S.D. (2006). Farm mechanization leading to more effective energy utilization for Cassava and Yam cultivation in Rivers State, Nigeria. Journal of Applied Energy. 83: 1317-1325.

Nwagwu, F. A. Tijani, Eniola H. and Chia, M.H. (2000). Influence of tillage and cover crops on weed control in cocoyam field at Ibadan, South – Western Nigeria. Nigerian Journal of Weed science. 13:39 – 44.

Oerke E.C., Dehne H.W., Schonbeck F. and Weber A. (1994). Crop production and crop protection: Estimated losses in major food and cash crops. Elsevier. p. 808.

Ojo, E. O. and Adebayo, P. F. (2012). Food security in Nigeria: An overview European Journal of Development. 1,2, 1999 – 222.

Okeleye K.A. and Salawu R.A. (1999). Use of low growing crops as an alternative weed control measure in Cassava - based cropping system in Southern Nigeria. Nigeria Journal of Weed Science. 12: 17-22.

Onochie B.E. (1975). Critical periods for weed competition in Cassava in Nigeria. PANS. 21: 54-57.

Orr, A., B. Mwale, & D. Saiti. (2002). Modeling agricultural 'performance': smallholder weed management in southern Malawi, *International Journal of Pest Management*, **48(4)**, pp 265–78.

Sibuga, K.P.(1997). Weed management in Eastern and Southern Africa: challenged for the 21st century. *16th East African Biennial Weed Science Conference Proceedings*, pp 5–11

Terry P.J. (1991). Grass weeds - A general overview. In: Baker, F.W.G. and Terry, P.J. (Eds.). Tropical Grassy Weeds. C.A.B. Int., Wallingford, U.K. pp. 5-38.
their weed management among small scale farmers in Nigeria.

Vissoh, P.V., G. Gbehounou, A. Ahanchede, T.W. Kuyper, & N.G. Roling. (2004). Weeds as agricultural constraint to farmers in Benin: results of a diagnostic study, *NJAS*, **52(3/4)**, pp 305–29.

World Health Organization (1985): Adopted from Hoddinott J. (2001) "Choosing outcome indicators of household food security" in J. Hoddinott(2001) ed. ***Food Security in Practice, Methods for Rural Development Projects***, IFPRI pp. 31- 45

Zuofa K., Tariah N.M. and Osoromah N.O. (1992). Effects of groundnut, Cowpea and Melon and yield of intercropped Cassava and Maize. Field Crops Research. 28: 309-314.