

A survey of cabbage production and constraints in Ghana

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ABSTRACT

A survey was conducted in 1993 to gather baseline information on cabbage production practices and constraints to develop safe management practices to combat insect pest problems on the crop. A questionnaire was used to gather baseline information from the 10 administrative regions of Ghana. The survey showed that cabbage was produced throughout the country, but less important in the Upper East and Western Regions. Cabbage production was noted to be increasing; however, pests and diseases were forces to reckon with, particularly in the Greater Accra, Ashanti, and Central Regions. About eight different cabbage varieties were grown in the country. Cabbage was produced all the year round on mainly rented lands in the urban centres. Both direct planting of seeds and transplanting of seedlings were practised. Notwithstanding, the first method had the problem of poor crop establishment. Major constraints identified included insect pests, namely *Plutella xylostella* and *Hullela undalis*, land acquisition and marketing. *Plutella xylostella* had become resistant to all available chemical insecticides in the country since 1990, and about 80 per cent of pesticides used to control pests on cabbage were chemical insecticides. Twenty chemical insecticides were used in controlling cabbage pests, most of which were not recommended.

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Introduction

Cabbage, *Brassica oleracea* var. *capitata* (L.), an exotic vegetable native to western Europe, is now

RÉSUMÉ

TIMBILLA, J. A. & NYARKO, K. O.: *Une enquête sur la production de chou et les contraintes au Ghana*. Un sondage a été entrepris en 1993 pour recueillir d'information de base sur les pratiques et les contraintes pour développer les pratiques de gestion sans risque pour lutter contre les problèmes d'insecte ravageur sur la culture. Un questionnaire était utilisé pour recueillir l'information de base des dix régions administratives du Ghana. L'enquête révélait que la production de chou est faite partout dans le pays mais moins important dans les régions de Upper East et Upper West. La production de chou est remarquée d'être en hausse, toutefois les insectes et les maladies sont des forces qu'il faut tenir en compte surtout dans les régions de Greater Accra, Ashanti et Central. Environ 8 différentes variétés de chou sont cultivées dans le pays. Le chou est produit durant toute l'année surtout sur les champs en location dans les centres urbains. Le semis direct de graines et le repiquage des semis sont tous pratiqués. Néanmoins, la première méthode a le problème de pauvre enracinement de culture. Les contraintes majeurs identifiés comprennent les insectes ravageurs, à savoir; *Plutella xylostella* et *Hullela undalis*, acquisition de champs et la commercialisation. *Plutella xylostella* est devenu résistant à tous les insecticides chimiques dans le pays depuis 1990 et environ 80 pour cent de pesticides utilisés pour lutter contre les insectes sur le chou sont des insecticides chimiques. Vingt insecticides chimiques étaient constatés d'être utilisés dans la lutte contre les insectes nuisibles de chou, dont la plupart ne sont pas recommandées.

popular among urban dwellers in Ghana. In recent years, cabbage, especially at repeatedly cultivated sites, has been severely plagued by the diamondback moth (DM), *Plutella xylostella* (L.)

(Lepidoptera: Plutellidae), the cabbage budworm, *Hullela undalis* (F.) (Lepidoptera: Pyralidae), and aphids, *Brevicoryne* spp. *Plutella xylostella* destroys the leaves, resulting in yield depression and total crop loss in endemic areas.

Insect pest damage on cabbage has been reported (Liu, Tzeng & Sun, 1982). The need for an integrated management practice which emphasizes biological control is of primary importance, because biological control agents are normally target specific and would eliminate the hazards posed to vertebrates, beneficial invertebrates, and the environment resulting from the use of chemical pesticides. Baseline information on cultivation practices and constraints to production of the crop is, however, unavailable in the country.

This study aimed at determining the current cultivation practices and constraints to cabbage production in Ghana to serve as a prelude to any environmentally friendly and sustainable management of important pests of the crop.

Materials and methods

Survey methodology

Visits were made to the capitals of the 10 administrative regions of the country. Staff of the Plant Protection and Regulatory Services Department (PPRSD) and the Department of Agricultural Extension Services (DAES), both of the Ministry of Food and Agriculture (MOFA), were contacted to map out important districts that produced cabbage.

Two to five vegetable farmer groups were interviewed in two to five separate localities in each of the selected districts of the regions in addition to frontline staff of PPRSD and DAES for complementary information. Each farmer group was interviewed, using a questionnaire, seeking information on common vegetables grown in each locality, cropping systems, farmers' practices, varieties grown, planting methods, weeding, and fertilizer application. Others covered insect pest and disease incidence and damage, management of insect pests and diseases, harvesting, storage,

marketing, utilization, and sources of finance.

Results

Distribution of vegetables grown in Ghana

The study showed that with the exception of eggplant, tomato, pepper and okra were grown throughout the country. The inhabitants of the northern regions ate the leaves of *Amaranthus* spp. and kenaf predominantly grown there. Cowpeas were also grown nationwide, and people of northern extraction ate the leaves and seeds while the southerners mainly consumed the seeds. In the Greater Accra and Ashanti Regions, however, consumption of the leaves was noted to be limited mainly to people of northern extraction. Table 1 shows that the distribution of exotic vegetables in the country as a whole does not follow any systematic pattern.

The Greater Accra Region recorded the highest number of exotic vegetables, with the least in the Western Region. With the exception of cabbage, carrot, cucumber, cauliflower, sweet pepper and broccoli, most vegetables grown in the Greater Accra Region were exported outside the country.

Cabbage cultivation practice

About 32.7 per cent respondents from the Greater Accra, Central, Ashanti, Brong Ahafo, Volta, and Northern Regions intercropped cabbage with tomato, onion, lettuce, sweet pepper and carrot, while the remaining 67.3 per cent from the other regions monocropped cabbage. About 6.1 per cent farmers indicated that intercropping reduced pest population while 14.3 per cent intercropped with the aim of maximizing land use.

Seasonal distribution and gender roles in cabbage production

About 46.9 per cent respondents indicated that they produced cabbage the whole year round (i.e., more than two times in a year), while some 24.5 per cent farmers cultivated cabbage only during the rainy season. The remaining 28.6 per cent produced the crop in the dry season only.

TABLE I
Exotic Vegetables Grown in Ghana

<i>Region</i>	<i>Vegetable grown</i>
Greater Accra	Cabbage, carrot, cucumber, cauliflower, snake gourd, mano, tinda, chinese beans, cluster beans, sponge gourd, ghiya (turia) chilli pepper, sweet (bell) pepper, broccoli, sprout, holland onions, water melon, and french beans
Central	Cucumber, cabbage, lettuce, water melon, chilli pepper, and sweet pepper
Western	Carrot, chilli pepper, and cabbage
Eastern	Cabbage, sweet pepper, squash, carrot, cauliflower, lettuce, french beans, cucumber, chilli pepper, and christophine.
Ashanti	Cabbage, carrot, lettuce, french beans, cucumber, water melon, chilli pepper, and sweet pepper
Brong Ahafo	Cabbage, lettuce, carrot, water melon, sweet pepper, french beans, chilli pepper, and cucumber
Volta	Lettuce, cabbage, carrot, radish, cucumber, chilli pepper, and sweet pepper
Northern	Lettuce, cucumber, carrot, and cabbage
Upper East	Cabbage, lettuce, carrot, water melon, and cauliflower
Upper West	Lettuce, cabbage, and pumpkin

Cabbage was intensively produced year round in the Greater Accra, Ashanti, Central, Eastern, Brong Ahafo, and Volta Regions. In the North, production of cabbage was most common in the dry season. It was noted that cabbage cultivation depended on rainfall, household taps, rivers, and wells for sources of water. In addition, some 16.5 and 14.3 per cent respondents in the Accra and Kumasi metropolitan areas, respectively, used water from open drains. This was due to the production of the crop along such drains and the high cost of treated water. Production of cabbage, using irrigation, was observed in the Northern Region and also at Weija in the Greater Accra Region.

The survey showed that the ratio of men to women in the cultivation of cabbage was 11:1. With the exception of the Greater Accra and Ashanti Regions, women normally assisted in watering, planting, and harvesting the crop.

Cabbage varieties, status of production, and farmers' time allocation

About nine cabbage varieties, namely Capitata, Copenhagen market, Oxylus, K-K cross, Tenzier,

Gloria, K-Y cross, Holland, and Master globe were recorded during the survey. The two most popular varieties, Oxylus and K-K Cross, were noted to mature in 3½ and 3 months, respectively.

Generally, cabbage production was observed to be increasing in the country, with the exception of the Greater Accra, Central and Ashanti Regions. Indications were that cabbage production was increasing as a result of increasing demand by local consumers and also increase in population of foreigners in the urban centres. Some 53.1 per cent respondents indicated that they cultivated the crop on part-time basis. The remaining 46.9 per cent engaged in full-time production of cabbage, out of which about 33.3 per cent were government redeployment staff.

Land acquisition

Land acquisition for cabbage cultivation was noted to be a serious problem in the Greater Accra and Ashanti Regions. About 20.4 per cent of farmers interviewed cropped cabbage on their own land. While 42.9 per cent of farmers hired the land, others depended on share cropping in the ratio of 1:2 for landowner and farmer, respectively.

Producers in the Central and Greater Accra Regions (10.2 %) normally farmed on government land. Another 10.2 per cent farmers in the Kumasi metropolis used land earmarked for private buildings, but moved to riverine areas during the dry season.

Cabbage farmers at Weija paid up to ₵400,000.00 for 5 acres of land per year when the survey was conducted. Small-scale farmers on plots ranging from 0.5 to 1 acre mainly produced cabbage in Ghana.

Labour

Some respondents (46.7 %) cultivated the crop without any assistance, while 20 per cent either depended on the family alone or on hired labour alone in addition to the farmer. Those who depended on family as well as hired labour in addition to the farmer were 13.3 per cent. At the time of the survey, a daily wage ranging from ₵450.00 to ₵2,000.00 was paid to farm labourers. Farmers in the Western, Northern, and Upper West Regions did not employ labourers to work on their farms.

Land preparation and planting

Land was initially cleared mainly by cutlass. Few farmers (7.1 %) used weedicides such as Gramoxone, Atrazine or Glyphosate. Ridges were then made by hoe or with spade. The practice of zero tillage, constituting about 18.4 per cent of respondents, was common in Winneba, Suhum, Wenchi, and Bolgatanga. The remaining 81.6 per cent cultivated cabbage on ridges. Indications were that planting on the bare soil (i.e., zero tillage) helped retain water during the dry season. In the Central Region (Winneba), one farmer remarked that under zero tillage, the plants could stay without watering for up to 2 weeks during times of drought.

Cabbage was usually planted with the help of hired labour and family members after nursing seeds for about 4 to 5 weeks. In Wenchi in the Brong Ahafo Region, some farmers practised direct sowing of cabbage seeds. However,

indications were that cabbage planted this way matured faster, though initial establishment was generally poor.

The survey showed that the crop was transplanted at 1 per hill at distances of 0.30 m × 0.30 m, 0.45 m × 0.45 m, 0.50 m × 0.50 m, and 0.60 m × 0.60 m apart in the evenings for better establishment. However, some transplanted during the day due to other activities. The most popular planting distance recorded was 0.45 m × 0.45 m (40.8 %) followed by 0.50 m × 0.50 m (16.3 %). Planting at 0.30 m × 0.30 m and 0.60 m × 0.60 m were the same at 8.2 per cent. About 26.5 per cent could not specify their planting distances.

Weeding

The field beds planted to cabbage were generally maintained by hand fork or some improvised instrument. Indications were that farmers in the Central, Western, and Upper East Regions did not encounter weed problems. Weed problems were, however, common in the other regions, particularly on poorly prepared land. *Cyperus* spp. were mentioned as major weeds, and farmers weeded two to three times before harvest.

Fertilizer application

Cabbage farmers in all the regions used organic and inorganic fertilizers which constituted 52.0 and 48.0 per cent respondents, respectively. Organic fertilizers, applied 2 and 4 weeks before planting, included cowdung, poultry manure, as well as pig and goat droppings. A few farmers, however, applied the manure after transplanting the crop. Common inorganic fertilizers listed by farmers were mainly various ratios of NPK such as 15:15:15, 20:20:20, or 23:15:5. Others included sulphate of ammonia and urea. Inorganic fertilizers were applied twice (i.e., about 2 weeks after transplanting and just before head formation), depending on the cabbage variety.

Some cabbage growers applied dilute solutions of chemical fertilizer to the crop at the nurseries. While some farmers applied the same kind of fertilizer, others used two different kinds at the dif-

ferent application times. Some farmers intimated that application of fertilizer resulted in larger cabbage heads. In the Eastern Region, some farmers applied hormones such as Arofol and Superfos.

Pests and diseases

Pests and diseases and, to a lesser extent, nematodes were noted to be constraints to cabbage production and predominantly in the dry season (Table 2). Of the insect pests, *P. xylostella* was identified as the most important, followed by *H. undalis*. Others included *Spodoptera* spp., *Crociodomia binotalis* and the cabbage looper, *Trichoplusia ni*. However, the last three are occasional pests of cabbage in Ghana. Indications are that the diseases are not as important as the incidence of pests.

Control of pests and diseases

The survey showed about 20 different pesticides used for controlling pests and diseases

(Table 3). Other control methods recorded included hand picking of insects and crop rotation. A farmer in Kumasi indicated that he intercropped cabbage with onion to reduce pest populations. The diamondback moth was most serious during the dry season, while heart rot occurred when harvesting was delayed during times of rain. Farmers in Winneba in the Central Region applied neem leaf extracts to control the diamondback moth.

Harvesting

Generally, the crop was harvested in the mornings and evenings and sometimes at any convenient time of the day. Farmers who had to transport their crop to the urban centres usually harvested in the evenings. This practice normally involved the farmers, their wives, children, and market women who were referred to as middle women.

Marketing

The price of cabbage head in the country at the

TABLE 2
Pests and Diseases of Cabbage in Ghana

<i>Growth stage</i>	<i>Pest</i>	<i>Disease</i>
Nursery	Reptiles, <i>P. xylostella</i> and <i>H. undalis</i>	Damping-off caused by species of <i>Fusarium</i> , <i>Phytophthora</i> and <i>Sclerotium</i>
Transplanting	Crickets, grubs, aphids, millipedes, grasshoppers, <i>H. undalis</i> , <i>P. xylostella</i> , <i>S. littoralis</i> , <i>C. binotalis</i> , and <i>T. ni</i>	Root rot and heart rot caused by fungi
Maturity	<i>P. xylostella</i>	Head rot caused by fungi and bacteria

TABLE 3
Pesticides and Fungicides Used for Controlling Pests and Diseases of Cabbage in Ghana

<i>Organism</i>	<i>Pesticide and fungicide used</i>
Disease	Furadan, Kocide and Dithane M.45
Pest	Cypermethrin (Cymbush), Actellic, Lambda cyhalothrin (Karate), Roxion, Elsan, Nogos, Elocron, Essam, Dursban, Sampi, Perfekthion, Diazinon, Magic chalk, Sumithion, Unden, Basudin, Ripcord, Dimethoate, Thiodan, Sebon, Fenitrothion, Biobit, Delfin, and Dipel 2X

time of the survey ranged from ₵100 to ₵500 per head and depended on season, abundance, demand, variety, and area of production of the crop. Generally, the cost of cabbage was higher during the dry season than the wet season, and the market women often dictated the prices. This compelled some farmers to send their produce to the urban centres to sell. During times of abundance, the crop was kept in the field much longer; thus, causing cracking and rotting of the heads.

Some farmers indicated that the cabbage variety grown could influence the price. Some preferred larger heads such as K-K cross, while others preferred heavier heads like Oxylus. Those who produced the crop under irrigation indicated that it was capital intensive and reduced profit margin. Thus, they often diverted their attention to the cultivation of other vegetables such as okra, eggplant, tomato, and onions.

Most cabbages produced in the Central, Eastern, and sometimes Volta Regions were sold in the Greater Accra Region by farmers or middle women. The remaining was sold within the respective towns, mainly along roadsides and farm gate.

Cabbages produced in the Brong Ahafo Region were usually sold in the Ashanti Region, especially in Kumasi. Cabbages produced in the Western and Northern Regions were not sold outside their territories. Producers in the Upper East Region had lost their market in neighbouring Burkina Faso because of price differences. The crop sold cheaper in Burkina Faso than Bolgatanga and its surroundings. Production and patronage of cabbage was low in the Upper West Region.

Utilization

Consumers of cabbage in the urban areas included foreigners and native urban dwellers. Most farmers consumed the smaller heads that did not meet market requirements. The survey showed that this exotic vegetable had been incorporated into many foods eaten in Ghana, viz. salads, stews, soups, and pastries. Hotels, restaurants, and local food sellers also used

cabbage in various food preparations for their numerous customers. The leaves remaining after harvesting were used as feed for pigs.

Financial support

From the survey, it came out that almost all cabbage producers in the country were self-supporting. The farmers faced this problem each year between February and June. Farmers at the Weija irrigation site near Accra, however, indicated that they used to enjoy a loan scheme whereby inputs were supplied on credit, payable at the end of the growing season. This, however, failed because some farmers defaulted in the loan repayment.

Some farmers stated that they were sometimes pre-financed by the middle women. Farmers in dam areas in the Upper East Region intimated that the water supply was usually credited to them and paid for at the end of the growing season. Some farmers remedied the financial problem by planting some fast-growing vegetables, such as lettuce, together with the cabbage to generate some income before harvesting the cabbage.

Discussion

Cabbage is grown nationwide and all year round mainly by men. The crop has seemingly replaced most leafy vegetables grown in the country. Monocropping of cabbage is still popular, though few farmers are becoming aware of the use of intercropping, including pest management. The use of intercropping with cabbage to manage insect pests is practised with success in Taiwan, (AVRDC, 1987); India, (Srinivasan & Veeresh, 1986); Mexico, (Maredia, Segura & Mihm, 1992); and in other countries. This technology needs to be incorporated into the crop management practices of cabbage and other vegetables in the country.

Some farmers indicated that K-K cross was the most preferred variety because it produced larger heads, matured earlier (i.e., 3 months), and was also able to withstand *P. xylostella* damage better than the next common variety, Oxylus. Others

preferred Oxylus because it produced heavier heads with a longer shelf life, though comparatively smaller than K-K cross.

The problem of land acquisition, as noted in the Central, Ashanti and Greater Accra Regions, could be solved if farmers moved into the hinterlands. One possible problem would be the lack of good access roads linking the villages to the urban centres.

Outstanding among the insect pests identified were *P. xylostella* known to attack cabbage leaves and head, and *H. undalis* which primarily destroys the terminal buds, resulting in multiple heading. *Plutella xylostella* had already developed resistance to Karate, which was once known to be very effective. The pestilence of *P. xylostella* had been reported by many investigators worldwide (Anonymous, 1992). Resistance of *P. xylostella* to chemical insecticides was first reported in Indonesia (Ankersmith, 1953). Subsequently, additional reports were also made by Talekar & Shelton (1993) in Indonesia; Barroga (1974) in the Philippines; Syed (1992) in Malaysia; Sun, Chi & Feng (1978) and Cheng, Kao & Chui (1992) in Taiwan; Hama (1992) and Tanaka (1992) in Japan; and Altmann (1988) in Australia. Others included (Tabashnik *et al.* (1987), Magaro & Edelson (1990), and Shelton & Wyman (1992) in North America.

The pestilence of *H. undalis*, particularly in nurseries, was reported in Guam (Muniappan & Marutani, 1992). The survey did not indicate any development of insect resistance to the chemical insecticides available for *H. undalis* control in Ghana. This notwithstanding, timely application of pesticides, beginning at the nursery stage, is required to mitigate the problem of *H. undalis* in cabbage production.

Three pesticides mentioned in the study—Biobit, Delfin and Dipel 2X— are recently introduced biological insecticides from USA with *Bacillus thuringiensis* var. *kurstaki* as the active ingredients (Chalfant, 1992). Unfortunately, however, reports indicate that *P. xylostella* has already developed resistance to *B. thuringiensis* in the

USA (Tanaka, 1992; Tabashnik *et al.*, 1992) where it was used for two consecutive years. From the above, therefore, the need to adopt an integrated approach cannot be overemphasized. The behaviour of *P. xylostella*, in particular, requires a well-planned integrated pest management approach in areas where cabbage is continuously grown.

The main reason assigned to the decrease in production of the crop in the Greater Accra, Central and Ashanti Regions was the menace posed by *P. xylostella*, particularly during the dry season. It was not indicated whether the crop was increasing or decreasing in the Western Region. This probably bears further testimony to the fact that the crop was unimportant in the region.

For the use of organic fertilizer in the cropping of cabbage, Suchorska (1992) reported in Poland that organic fertilizer always improved cabbage cropping, with the highest average yields being on plots receiving farmyard manure and NPK. This claim, however, needs to be investigated in addition to determining standard organic fertilizer requirements of the crop. Indications, however, were that the use of organic manure reduced the shelf life of the harvested crop. It is known that cabbage can be processed and kept for use throughout the year in Russia (Sobotie, 1993: Pers. comm., Soil Research Institute, Kumasi). This could be taken up by the Food Research Institute of the CSIR, other food research institutions, commercial firms, and food-processing companies to avert the problem on the use of organic fertilizer, and also prevent the loss of cabbage during times of bumper harvest.

Conclusion

Cabbage production is generally increasing in Ghana due to factors such as redeployment and increase in consumption by local and foreign inhabitants. However, pests and diseases are a force to reckon with, particularly in the Greater Accra, Ashanti, and Central Regions.

Plutella xylostella and *H. undalis* are the most important pests hindering cabbage production in the country. This results from all year round cul-

tivation of the crop. Also, *P. xylostella* has developed resistance to chemical insecticides in the country.

About 85 per cent of pesticides used to control cabbage pests in the country are chemical insecticides, and most insecticides are not recommended for controlling cabbage pests.

Farmer field schools need to be set up to educate farmers on current techniques for producing cabbage.

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