

AGRICULTURAL HEALTH IN THE GAMBIA I: AGRICULTURAL PRACTICES AND DEVELOPMENTS

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Kuye R, Donham K, Marquez S, Sanderson W, Fuortes L, Rautiainen R, Jones M, Culp K: Agricultural health in the Gambia I: agricultural practices and developments. *Ann Agric Environ Med* 2006, **13**, 1–12.

Abstract: This manuscript reports results of our study to characterize the historical developments of agricultural practices in The Gambia and related health risks of farm workers. It surveys the various factors that shape production agriculture in the country and examines the degrees to which hand tools, animal traction, motorized traction and manual labour all contribute to the inherent hazards of farm work. The principal objective of this study is to lay the ground work for detailed research of occupational health hazards in Gambian agriculture; and development of policies and programmes to promote the health of Gambian farmers. The authors of this paper assume the belief that one must first understand the industry and its people before effective policies and programmes can be developed. The study concludes by highlighting the need for the integration of epidemiological investigations in the country's agricultural research programme.

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Key words: Agriculture, agricultural practices, farm labor, health and safety, The Gambia.

INTRODUCTION

Agriculture has been practiced in The Gambia since recorded history. Shifting cultivation has been the norm for a long time. Crop production has been mainly for food and with a secondary role, cash. The food crops have primarily been cereals and the cash crops, peanuts and some cotton. However, recent agricultural production has been diversified to include vegetables and fruits for the domestic market and export. Livestock production has also registered increases.

Agriculture in The Gambia is going through a transition. Traditional methods of farming are still practiced. Animal traction utilizing the *Sine Hoe* is well established, but fully-fledged mechanization is yet to be realized. Farming still entails a lot of labour as many of the tasks

are performed physically or manually. Personal protective equipment (PPE) is not used by farmers during work. Consequently, the health and safety of the farmers are compromised.

THE EARLY SYSTEM (1500s-1924)

LAND CLEARING

Historically, Gambian agriculture has been largely subsistence and based on a system of slash and burn. As land clearing had been a necessary precondition for cultivation, it consisted essentially of the massive felling of trees and destruction of virgin forests, where new areas were to be farmed. In those days, all male members of a family or compound would gather before the onset of the

rains to clear the fields, which they did with axes, cutlasses, hoes and rakes, before heaping and burning the clearings at the end of the exercise [23, 75].

FARM TOOLS AND EQUIPMENT

Agriculture was entirely rain fed and farming small-scale. Farms were scattered units that rarely exceeded two hectares in size; but all labour was intensive and manual. Among the tools used to do farm work was the *darambo* (hand plough used for making ridges), the *dabandingo* (a hoe used in the weeding of upland crops), the *dabajango* (a long hoe used by women for ploughing rice fields), the *fantingo* (a short hand plough used in upland and lowland cultivation), the *konkoduwo* (a shorter hand hoe used for planting), the *falajango* (a short hoe for making planting holes), the *luparango* (a club used for marking planting holes on ridges for upland crops), the *tia-sikarango* (an implement for lifting and transporting windrows to the main stack for proper drying) and the *tia-busarango* (a hook-like instrument for threshing peanuts). All these tools were crafted by local village artisans, who were very busy craftsmen in their day [11, 75].

CROPS

The crops cultivated were both indigenous and of foreign origin. They included rice, sorghum, millet, *findo* (*Digitaria exilis*) and *Bambara* groundnut (*Veandzeia subterranea*). Maize was brought to The Gambia from the Americas between the 18th and 19th centuries. Peanuts were introduced by the Portuguese in the 16th century and spread slowly as a fairly drought resistant diet supplement, to become widely cultivated in the country [34, 72].

CROPPING

Farmers used to plough the fields after the first rains which started by mid-May or early June. Upland fields were ploughed into ridges with the hand plough but the swamplands were tilled with the long hand hoe. Depending on the number of workers involved, it took about 3-5 days to plough an average size farm of 2-3 hectares [5, 42].

Planting was done by hand and was a task that could be accomplished by one or more people in a day or two. Seed holes were made on the ridges with clubs, into which the farmer dibbled 2-3 seeds per hole and then buried them by stamping the hole with the sole of the foot. Where more than one person planted seeds, one would lead to demarcate the holes, followed by those who dropped and buried the seeds. The logic for dropping multiple seeds in a hole was that if one failed to germinate, the others would. Rice was sowed by broadcasting but many preferred to raise it in nurseries and then carry the seedlings to the field for transplanting [5, 37, 56, 61].

Weeding was also performed manually with the hand hoe. Upland crops required 2-3 weedings while swamp rice required an average of two. Since it had to be done more than once for each crop, weeding was considered a very laborious task in farming [5, 42, 61].

In a good season, harvesting began in late October or early November. Peanuts were harvested with hand hoes or diggers, windrowed and then stacked for thorough drying before threshing. Millet and sorghum were harvested by forcefully pulling the plants to lie flat on the ground, chopping off the ear-heads with cutlasses and then tying them up into bundles. Rice being a cereal that droops on maturity was harvested differently. The pinnacles were cut at the base, one at a time, with a hand knife and then tied into bundles. Maize on the other hand, was harvested by simply plucking the ears from the stalks [5, 40, 61].

After harvesting, the crops were transported either by head or loaded onto donkeys to be sun dried on roof tops or platforms at the homestead. But peanuts had to be threshed on the farm by beating off the pods from the vines with long hooked implements in readiness for winnowing. Winnowing was effected by loading the threshed material into small baskets and letting it fall from a height for the wind to blow off and separate the vines from the pods. The pods were then hand picked and bagged. The bagged nuts were eventually loaded onto donkeys, two at a time, for final transport to the home. Hence it became customary for farmers to measure the yield of a peanut harvest by the number of donkey loads it produced [42, 55].

CROP GUARDING

As many of the farms were tiny holdings in the bush, the guarding of crops from pest attack, especially at maturity, was necessary. Crop guarding was carried out during the daylight hours mainly by boys (although girls sometimes guarded the rice fields). They were sent out early in the day to sit in the fields to scare away birds and monkeys. Some guarded the farms with intermittent shrill sounds, scarecrows, cutlasses, catapults and dogs. But where dangerous wildlife was of concern, adult males sometimes guarded the fields with guns and dogs [55].

FARM PRACTICE AND INPUTS

Very few resources were used in farming. Manure came from the ashes of burned clearings, from dung dropped by cattle tethered on a farm the previous dry season and from domestic garbage that was applied mostly to coarse cereals. Farmers believed that slash and burn was good for the crops, increased soil fertility, controlled weed growth and reduced weedings [55, 75].

As few resources were returned to the soil, farmers soon came to realize that the fertility of the soil diminished after some years of cultivation, and as such, resorted to a system where they would farm a particular piece of land for some years then move on to new site, leaving the

former to lie fallow, to be reclaimed by natural vegetation that regenerated its fertility in about 20 years [27, 28].

In conjunction with leaving land to lie fallow, early farmers also practiced crop rotation and intercropping. Crop rotation was a strategy to balance the nutrient content of the soil and the nutrient demands of the crops. Sowing *findo* or peanuts the first year, late millet the second year, early millet or sorghum the third year and again peanuts the fourth year on the same piece of land is an example of the type of crop rotation practiced [55, 71].

By intercropping, farmers planted different crops with varying nutrient and water demands on the same plot, to foster the organic restoration of the soil. Some of the methods employed in the uplands included intercropping peanuts with millet, maize and early millet with late millet, and sorghum with late millet [27, 61].

FARM FAMILIES

The farm family in the traditional setting consisted of a man with his wife or wives and sons and daughters. At times, it also included under-age younger siblings, step-children, nephews, nieces and other distant relatives. Farm families lived away from the farm to which they commuted daily during the farming season. However, the homestead was an extension of the farm because it was where livestock was raised, farm equipment stored and some crops grown. Farmers either took their lunch with them to the farm or had it brought to them about midday. Farm work generally started at dawn and ended at dusk and a farmer could spend half an hour or more walking to and from the farm [65, 69, 70].

LIVESTOCK

Besides crop farming, livestock was essential to the rural communities. Although involvement with livestock and the degree of sedentariness varied between different ethnic groups in The Gambia, from historical view, the *Fula* ethnic had long been associated with cattle herding. However, no selective breeding for beef or milk was practiced and services to protect animal health were nonexistent [34].

Cattle were raised by the open kraal system. In the evening, the animals were tethered on farms for their dung to increase soil fertility. During the day, the animals were herded free range over great distances to feed on naturally occurring grass and drink from rivers, streams and ponds. To the *Fula*, cattle were regarded as wealth and security. Thus, it might be permissible to imply that the need to move animals over long distances in response to seasonal changes in the availability of water, pasture and fodder had adapted to the nomadic lifestyle of *Fulas* in The Gambia well before the 1900s [23, 28, 34, 55].

AGRARIAN CHANGES

In the period between the 1880s and the 1990s dramatic changes occurred in the social organization of labour in

The Gambia. Demands for oils and fats for the manufacture of soap, candles and lubricants increased in 19th century Europe and America; making it necessary to import peanuts and palm oil from the tropics. The British introduced peanut overseas trade in the 1820s and it found immediate response among African growers. It soon became clear to farmers that they now had to look beyond the immediate family work force for extra hands to help work the fields, which led to the formation of farm work groups [34].

AGRICULTURAL WORK GROUPS

By the mid 1920s, many types of work groups were already operating on the farms of rural Gambia. A popular type was the *dabada*. The word *dabada* is a very complex term with several meanings in *Mandingka*. Originally it meant a farm labour group of young, able bodied men, exclusive of the old, the very young, the sick and all females [21]. Traditionally, payment for *dabada* labour was reciprocal and not in cash. Men's crops were cultivated by the *dabada* in order of seniority of the village members, which was at times unfavourable to junior members because their farms were either late or never reached [12, 13, 21].

Another type of work group was the *kafo*. The word *kafo* is a *Mandingka* term meaning a large group of village males or females. When a *kafo* worked a farm, the group was fed by the host and at the end of the day, was either given a bull or paid in cash. But there were times when *kafos* helped farmers without payment. This unpaid help called *babaro* was usually done out of friendship [21, 22].

Besides contracts, daily wage labour and temporal workers that were hired at the beginning of the planting and harvesting seasons, a unique kind of farm labour was a type of migrant workers known locally in The Gambia as "strange farmers". Such were seasonal migrants of thousands of men that started coming into The Gambia, to work the peanut fields, around 1830 [22, 70]. Although a few of them came from other parts of The Gambia, the majority were from Senegal, Mali, Guinea and Guinea Bissau [21, 73].

Most times, the local farmer (the host) and the migrant were complete strangers to each other. The host provided the migrant with room, food, seeds, farm tools and a plot of land to cultivate peanuts for his own use. This plot was either a part of the host's land or borrowed from the *Alkalo* (village head). In return for such favours, the migrant worked on the host's farm for 3 days and the rest on his own. At times there was no fixed number of days; the host and migrant just worked together on each other's farm. Occasionally, the migrant would collect firewood for the host at the end of the working day or help him build or repair his house [75].

At the end of the farming season, the migrant paid tax to the *Alkalo*. A strange farmer could return to the same host or village for several seasons, or even get married and settle permanently in the village, if the relationship was cordial [65, 75].

In 1915, there were 32,220 strange farmers in The Gambia [22, 70]. By the 1940s, it was estimated that migrants contributed about a third of the annual peanut export of The Gambia. But their numbers declined with the drought of 1975 and today, it is a mere fraction of what it used to be [73].

LAND TENURE

Land tenure in The Gambia, has and still is, complex and contentious. For the past 150 years many systems and variations of the same system have evolved among various rural communities and ethnic groups in the country. But the basic precepts are relatively the same. Land belongs to the extended family; it could be utilized, inherited or subjected to a term or condition but could not be mortgaged or sold [26, 60].

Traditionally, upon the founding of a village, original rights to the land were gained by those extended families that cleared it. The land was then demarcated into sections; comprising allocated plots for homes for each extended family of the founding settlers, with due regards for public amenities like streets, mosques, cemeteries, etc. The residents all lived within the village, commuting to the surrounding farm land. The farm land was divided into planted or fallow croplands, grazing land and women's gardens and rice fields. Crop and rice lands were held by lineages or occasionally by individuals under usufruct [60].

Other families could come and settle in the village. But upon arrival, these late comers had to have chosen a founding family as host, who would give portions of its land for settlement and farming or seek it from other founding families. Such gifts of land were regarded as conferring permanent ownership, with all rights and privileges, to the new arrivals [55].

The eldest male in the extended family assumed the position of family head: and would allocate land to his younger male siblings or in their absence, to their sons. Upon the death of a family head, the next eldest brother or lacking this, the eldest of the sons within the extended family succeeded him [26].

Land owning families could give land to their daughters for rice farming, even though they left and married into other families. However, in the case of childlessness such land reverted to the original family [26, 44, 75].

If the male members of a land owning family happened to decrease due to death or migration, such a family could bestow custody or lend its land to others in the village. The custom was that borrowers paid ten percent of their harvest to the land owners at the end of every growing season. Borrowers were not allowed to plant trees on borrowed land because that connoted ownership. The lending family could regain its land when needed, but could only do so after harvest and not while under cultivation. This system of land inheritance was respected and venerated and is still practiced [26].

FORMALIZATION OF AGRICULTURE

Agriculture in The Gambia became formalized in 1924 when a department of agriculture was established. In those days, demonstrations were the primary activities of the department of agriculture [50]. It started out as demonstration plots in Bakau, where exotic species of plants were tried for their suitability to The Gambian climate and ecology. Peanuts did so well that efforts were made by the then colonial government to increase its production. Reliance in peanut production increased so much in the 20th century that it took over as the major cash crop of the country [50, 65].

THE PRESENT SYSTEM (FROM 1924 TO PRESENT)

ANIMAL TRACTION

The mechanization of agriculture started in The Gambia in the 1940s with the animal powered single purpose *Sutlidge* mouldboard plough. But the first real move from the traditional hand cultivation began in 1957, when the *Emcot* ridger was introduced together with the ox-cart [39, 63]. The *Emcot* minimized drudgery in land preparation [16]. However, its main disadvantage was that it replaced some of the physical labour by use of animal traction in ploughing, leaving planting and weeding to be performed manually [64, 65]. But because it allowed for inter-row weeding and aided fertilizer uptake by plants, it became popular with farmers that practiced ridge cultivation and remained as the most improved farming practice, until the advent of the *Aplos* and *Xplos* ploughs from Britain in the 1960s [39, 64, 65].

However, *Aplos* and *Xplos* found less favour with many farmers because they were too heavy and expensive; and were soon taken over by the *Sine Hoe* in the 1970s.

Manufactured by Siscoma/Sisma in Senegal, the *Sine Hoe* is an animal powered multipurpose frame which accepts a variety of attachments including the mouldboard plow, 3-4 tine weeders, peanut lifter and an earthen-up attachment for cotton. It was tested extensively by Matthews and Pullen in 1975-76 and found suitable for all crop ecologies in The Gambia [39, 51, 52]. By 1980, the *Sine Hoe* had gained the acceptance of the many farmers in the country, and is today widely used [17, 18, 63]. When used with the *Super Eco seeder*, it allows minimum till in dry conditions. The *Sine Hoe* maximized the utilization of carts and draught animals, especially the horse and the donkey whose populations came to increase greatly [53, 54, 65].

MOTORIZED TRACTION

The use of mechanical traction in The Gambia began in 1952 [38]. It started as the Tractor Ploughing Service (later renamed Riceland Mechanization Service) that was jointly owned by the Department of Agriculture and the Colonial Development Corporation [16, 57].

After World War II, the British attempted to mechanize and commercialize rice production in The Gambia and introduced four wheel tractors to the rice swamps in Sapu [44]. These initiatives led the way to more government and corporate interventions, and by the 1970s, two wheel tractors also known as power tillers, were introduced in irrigated rice production by the Taiwanese and Chinese [57].

In the 1980s, The Gambia Commercial and Development Bank (now defunct), in its bid to transform rice mechanization to a private entity, purchased tractors and loaned them to selected farmers. In 1996, the first batch of 20 four wheel tractors were imported by The Gambia government and given to farmers in promotion of an intensified mechanization of rice production. More followed in the succeeding years [43, 44].

Despite the fact that tractorization reduced drudgery, increased efficiency, boosted productivity and enhanced timeliness of operations, some agriculturalists feel that it was not introduced within the framework of a well-designed programme to determine the most appropriate type for the different rice ecologies [15, 16, 65]. The Gambian soil is too light and four wheel tractors over-pulverize it, resulting in erosion and the loss of valuable top soil especially in the uplands. Furthermore, tractors are too expensive for farmers to maintain and many of the farmers are not trained to use them. The indicators are that power tillers work better than tractors in Gambian wetlands because they are smaller and lighter and can also be used in upland soils [15, 38, 25].

CURRENT AGRARIAN SITUATION

The system of farming prevailing in The Gambia today is mixed. Traditional and improved methods are practiced alongside each other. Agriculture is still rain fed, shifting with slash and burn. But an increasing population pressure is gradually reducing the fallow period, encouraging continuous cropping and soil degradation [45, 46]. Farmers are now aware of the importance of fertilizers, pesticides and good quality seeds. Sesame has been introduced by a local aid agency and is undergoing its trial phases. Similarly, cotton farming has been revitalized in the eastern parts of the country. The use of draught animals has been fairly successful but the same is not true for full-scale mechanization with conventional tractors [29]. As of the year 2002, 73.4% of all farm work in The Gambia is carried out with animal power, 24.9% by human power and 1.7% by mechanical power [58].

Agriculture currently accounts for 25% of GDP and provides employment for nearly 75% of the rural population. The total area of cultivated land increased from 193,000 hectares in 1994 to 250,000 hectares in 2001, representing a 30% increase [30].

However, the majority of farmers are small holders with less than 3 hectares of land per farm family. Livestock is still largely kept under the traditional system and contributes 5% to GDP [32]. The agricultural density is high with about 103 people per km² of agricultural land [58].

CROP FARMING AND PRODUCTION

Crop farming comprising legumes and grains still predominate in Gambian agriculture. With the exception of rice which is cultivated mostly in the lowland swamps, all the other crops are produced in the uplands [5, 19, 61]; and include:

Peanuts. Peanut is the crop grown for cash; and about 45% of the cultivated area is allocated to its production [58]. Land clearing for peanuts starts from late April and may continue until early June. As in the past, the land is cleared with hand tools (axe, cutlass and rake) after which the clearings are burned [5].

Ploughing starts after the first rains and is done with the hand hoe, but more commonly with the animal powered *Sine Hoe*. The ox, horse or donkey may be used for ploughing or planting, but the horse is the favourite because it is faster. Tractors are not encouraged because they plough too deep and impede proper growth [69].

Formerly, farmers used to plough before sowing but now the common practice is "direct seeding" or "minimum till"; which has the advantage of covering the seeds and conserving moisture to promote better germination and pest protection [5, 69].

First weeding is effected about ten days after planting or soon after the seedlings emerge. It may be done with the *Sine Hoe* but more so with the hand hoe. Farmers also apply fertilizer manually during first weeding. This saves labour and makes incorporation into the soil easier [5].

Second weeding is normally done 2–3 weeks after the first and where necessary, as in the case of heavy rains, a third weeding is carried out 10–15 days later [5, 42].

Weeding is crucial for peanut growth and should be repeated as necessary; but because it is a very laborious job, farmers rarely weed more than twice [5].

The plants flower in 8–9 weeks; and depending on variety, maturity sets in between 90–120 days after planting [42]. Maturity is manifested by the yellow discoloration of the leaves, shedding of older leaves and darkening of the inside of the shell [37, 69].

Harvesting may start in late October. It may be done with the hand hoe but the *Sine Hoe* mounted peanut lifter is now common. After the nuts are lifted, they are windrowed then stacked for aeration and drying. Peanut harvesting is a time-sensitive operation. Harvesting too early may result in immature nuts being harvested, too late may cause many of the nuts to be left in the soil and stacking for longer than two and a half weeks make the nuts vulnerable to irregular weather such as "freak rainfall", temperature extremes, moulds and pest infestations [5].

Threshing and winnowing are the last two stages in the farming process and are performed manually. Threshing is done by "beating" small heaps of the dried nuts with threshing sticks to separate the pods from the vines. This may take 1–3 weeks and generates a lot of dust. Equally laborious and dusty is winnowing which consists of loading the threshed nuts into small pans or baskets that are



Figure 1. Sine hoe with seeder.



Figure 3. A tractor at work.



Figure 2. Tractors leaving an agricultural station for the farm.



Figure 4. Farmers winnowing threshed peanuts.

carried up a raised surface and allowed to “pour drop” from a height for the wind to blow and separate the vines from the pods which are then hand picked and bagged [69].

The bagged pods are later loaded onto animal drawn carts for transport to the home. In the home, seeds for the next farming season are selected. The selected seed nuts are dressed with pesticides and stored either at home or the village seed store. Some of the nuts are saved for food but the greater quantity is taken to the buying station and sold for cash [5, 42, 69].

Cotton. Cotton farming is concentrated in the eastern part of the country where it has been grown as a backyard crop for years [49].

Commercialization of cotton started in the 1970s, as a development project (The Gambia Cotton Project) to diversify the economic earnings of the country and lessen its dependence on peanuts. But the attention given to peanuts far surpasses that of cotton [24, 49].

Land preparation and planting practices are the same as for peanuts, although some still prefer to use the hoe and planting stick. Ideally, planting should be done between 15 June–15 July; but could be extended to 20 July in the case of late rains [68].

The seedlings appear 2–3 days after germination and weeding commences approximately 10 days later. Weeding is done with the hand hoe or *Sine Hoe*, when fertilizer is also applied by broadcasting. Cotton needs 2–4 weedings which are necessary for the maintenance of field hygiene and the reduction of pesticide applications. Technically, 6 pesticide applications are recommended, but good field hygiene could mean 2 less pesticide sprays [49].

The bolls may appear 6 weeks after planting and may mature by October, splitting open when ripe to expose the lint. Harvesting begins as soon as about 30% of the bolls split open and is done by the farmer with his family or hired help. The lint is hand picked, put into baskets or sacks to be later stored in a cool environment to maintain the right humidity and purity of the lint until it is sold [49, 68].

Upland Cereals. Maize, millet, sorghum and *findo* are the cereal crops that are grown for food in the uplands. Some rice is grown in the uplands but not as much as in the lowlands.

All cereals share the same land preparation and sowing techniques; consisting of field clearing with hand tools, on-site burning of the clearings, ploughing with the



Figure 5. Drying harvested sorghum on the roof of a rural homestead.



Figure 7. Tethering cattle on a harvested field.



Figure 6. Harvesting rice with hand knife.



Figure 8. Sheep and goats at the homestead.

donkey or horse powered 3 tine *Sine Hoe* and planting as soon as ploughing is complete and the rains begin. For maize, millet and sorghum direct planting on unploughed land is possible. Millet is sometimes transplanted for gap filling but many choose to plant it on ploughed ridges with the seeder. *Findo* is primarily planted by broadcasting and with adequate moisture; the seedlings emerge in 2–3 days [42, 61]. With the exception of *findo*, which requires very little weeding, the others demand an average of 2 weedings each, with at least 1 fertilizer application which is done manually [61].

Findo matures early, mostly when the food supply is low; but the others mature later. *Findo* is harvested with the hand sickle, sun dried for about three days, then threshed by manually beating it with clubs or tramping it with the foot; after which it is winnowed and bagged [42].

Maize is harvested by hand plucking the ears from the stalks, sun drying for about a week, and then hand shelled and bagged. Harvesting of millet and sorghum is done by felling the stands and cutting off the ear-heads with cutlasses. The ear-heads are then tied into bundles and transported to the home on animal carts. In the home they are sun dried either on platforms or roof tops, then stored, to be threshed and milled as needed [42, 61].

Rice. Rice is the nation's dietary staple and rice farming is one of the women's roles in Gambian culture. Most of the rice is farmed in the tidal swamps - *banta faros*, *leofaros*, *wamifaros* and *bafaros* [12, 13, 41, 61].

With the exception of the large irrigated rice growing schemes, e.g. Jahally Patcharr and Sankuli Kunda, where mechanized farming prevails; the ordinary small-scale rice farmer works the farm with either hand tools or draught animals, with hand tools predominating, because they are more affordable for women [37, 64].

Ploughing and harrowing of the lowland swamps are carried out during low tide, early in the rainy season. In many instances, the land is tilled with the long hoe but the ox-plough is occasionally used. Men may help or be hired to stump virgin swamps, construct causeway ridges, bonds and foot bridges where needed [56].

Planting may begin in June or July, depending on variety. Some plant by broadcasting but the common practice is to nurse the seedlings in backyards or *banta faros* and then transplant them to the tidal swamps. First weeding is effected 2-3 weeks after transplanting but where the land is well prepared and water is stagnating in the field, this may not be necessary. Weeding is done with the short hoe or by manually uprooting the weeds. Second

weeding is done exactly like the first but is carried out to coincide with the reproductive stages of the plant 35-45 days later. Those farmers that can afford it apply nitrogen fertilizer just after weeding. Weeding is a tedious and time consuming task that takes about 25 days [61].

Depending on variety, rice matures between 90–120 days. When maturity occurs, the stalks and leaves dry out and the pinnacles droop. The paddies harden and turn yellowish brown in color. Crop guarding is intensified because the paddies are now prone to bird and other pest attack [4, 37].

Harvesting starts in late November or early January. This is another arduous task that entails long periods of standing and stooping, because rice is harvested by cutting the pinnacles one at a time with the hand knife. After harvesting, the paddy pinnacles are tied into hand-size bundles for transport to the homestead either head-loaded or on the donkey or horse cart. In the home the paddies are sun dried on mats, platforms or roof tops; then threshed and stored or manually dehulled and then stored. Some communities have village dehulling and milling machines where the paddies are processed mechanically [4, 57]. In some cases, these machines generate heat, smoke, dust, noise and vapour, especially when they age or lack maintenance and are operated in an enclosed space.

Horticulture. Women are the principal producers of the traditional vegetables like okra, bitter tomatoes, sorrel and other types of greens for the domestic market. The boom in vegetable production started with the growth in international tourism in the 1970s, when the growing of onions was encouraged to satisfy the demands of local hotels [10, 12].

By 1986 exotic vegetables like lettuce, tomatoes, carrots, green and chili peppers, egg plants, beans, cabbages and tropical fruits like avocados, guavas, mangoes, papayas, limes, and lately, flowers, have become common produce. Horticultural production was commercialized around the urban centres in the 1990s making it an activity of all seasons; supplying local hotels, the expatriate community, neighbouring countries and Europe [8, 12, 14, 30].

Horticulture in modern Gambia falls in three main categories: 1) the mechanized and highly commercialized export oriented large-scale gardens of 100 hectares or more; 2) the medium-scale, women's communal, village-based donor supported schemes of 5-20 hectares - some may have irrigation systems; others; bore holes or concrete wells, with or without pumps; 3) the small-scale gardens of less than 5 hectares that are spontaneously adopted by women using low technology. Well construction, fencing, tillage and watering are often done manually. This category is more common in the rural areas where the use of residual moisture of inland rice swamps to cultivate vegetables is practiced [13, 14, 30].

The garden is fenced with palm fronds or barbed wire supported with logs. The land is cleared with cutlasses and rakes and the clearings burned on site. Tilling is done

with the hand hoe and the beds are made with a spade or shovel and a rake. The seeds are sown directly onto the beds or the seedlings are transplanted to the beds from nurseries. Some add manure. Depending on what is available, cow, horse, donkey, sheep, goat or chicken manure or a combination of all may be introduced either before planting or after weeding [8, 10, 36, 62].

The most laborious tasks of vegetable gardening are watering, weeding and pest control. Water is retrieved from the wells manually with bucket and rope, or by hand or windmill pumps, and the beds are watered manually. Vegetables are generally watered twice a day in the dry season. With deep wells, watering may take about 2 hours, but with shallow wells, it may stretch up to more than 4 hours per session [9, 10, 14].

Some vegetables need more than two weedings, which are mostly done with the hand hoe. Pesticides of various types may be applied. In most cases, pesticides are applied with no personal protective equipment. At times, the vegetables have to be guarded against monkeys and birds [69].

Depending on the type of the vegetable, harvesting may begin as early as 6 weeks after planting. All harvesting is done manually; and may entail head loading baskets of bulky and heavy farm produce for long distances [36, 69].

LIVESTOCK FARMING

Livestock raised by farmers in The Gambia include cattle, sheep, goats, chicken, pigs, horses, donkeys and mules. However, there are variations in the ways that the animals are raised.

Cattle. The traditional cattle herd is the *Ndama* breed, with some *Zebu* and crossbreeds of the two. The crossbreeding of *Ndama* with *Holstein Friesian* for increased milk yield and quality is carried out by the International Trypanotolerance Research Centre (ITC) [67].

Sixty-four percent of extended farm families (*dabadas*) own cattle and the average number per family ranges from 6–20. Cattle are raised under a low input system, where they are contracted to herders who are paid in kind by selling and keeping proceeds from the milk. Two types of management prevail. One is the extensive and subsistence system that is characterized by grouping cattle into herds of 20 to over 100 that are herded free range during the day to graze on unimproved pasture and tethered at night on harvested fields for their dung to restore soil fertility. A sub-type of this system is “transhumance herding”, which entails moving cattle across districts and borders for grazing and watering during the dry season.

The other system is semi-intensive and limited to draught oxen and lactating cows. Here oxen are tethered during the rains and stall fed in the dry season. Feed is supplemented to ensure good health and labour output during cultivation [30].

Cattle are watered from surface water in the rainy season, but mostly from village wells, with heavy labour, during the dry season [31].

Sheep and Goats. The small ruminant population comprises *Djallonke* sheep and The West African Dwarf Goat. Crosses between other large Sahelian breeds with local breeds are gaining popularity among farmers [30]. More farmers own sheep and goats than cattle. Approximately 80% of rural households own at least a sheep and a goat [30, 31]. Sheep and goats are kept in flocks in the homestead.

During the cropping season, farmers pool their flocks together and entrust them to hired shepherds for herding away from the farms [67]. In the dry season, the animals graze free range on available pasture and scavenge on domestic waste around the village. Fodder or bran is given to lactating mothers and those selected for ceremonial slaughter. The animals are watered in the morning before they are released for grazing and also in the evening when they return to the homestead. Many farmers provide their animals with shelter [30, 67].

The droughts of 1968-73 and 1973-74 decimated large herds of cattle; since then there has been a shift from cattle to small ruminants which are more drought resistant [31, 67]. There is presently a high commercialization of small ruminants and a market oriented sheep production system known as “ram fattening” is practiced. Under this system, rams that are undesirable for breeding are castrated and fattened for sale by feeding them peanut hay supplemented with cereal bran and oilseed cake over a period of 3-6 months [30, 32, 48, 67].

Poultry. The poultry population of The Gambia is difficult to ascertain. It is estimated at over 600,000 birds; and the average flock size is 15-30. Poultry is a valuable asset for rural farmers and is mostly owned by women and children. The birds are housed at night and left free to scavenge during the day, but are sometimes fed garbage, grains and cereal bran. Chickens in the rural homestead lay an average of 40 eggs per year and attain a live weight of 0.3–0.5 kg in about 8–9 weeks [30].

The crossing of local chickens with exotic species has resulted in improved growth rate and increased egg production. Small-scale, market-oriented schemes are now emerging in the villages, but more so around the urban areas where they cater to the hotel industry [30, 31, 38].

Pigs. Hog farming is a very small sector of agriculture that is practiced by non-Muslims. A small-scale production system prevails, catering to the hotel industry and the Christian and expatriate communities. Breeds are either local or crosses of local with exotic varieties. The animals are generally kept in earth or deep litter sheds in the homestead. Most farmers use swill as feed but when this is unavailable, leave the animals free to scavenge on garbage [30, 67].

Draught Animals. The ox, horse and donkey are the main draught animals in The Gambia; but a few farmers use cows to work the farms. Draught animals are mostly

owned by men who give them preferential treatment as far as feed and health care are concerned [30, 31].

Horses are usually well cared for. They are tethered year round and fed quality peanut hay supplemented with millet. Farmers identify stallions that are desirable for mating and pair them up with mares for breeding. The services of stallions are sometimes paid for in cash or in kind with grains [30, 31, 67].

Donkeys are not very well cared for. During the rains, they are tethered and fed peanut hay but in the dry season, are left free to graze and scavenge for food. Breeding is seldom controlled [30]. However, the donkey is the most affordable draught animal and donkey powered carts are the most common means of transport in farming communities. Here donkey carts, without lighting and marking features, and often overloaded with people and farm materials, are a major hazard to motorized traffic on rural roads; especially at night.

WOMEN AND AGRICULTURE

In many developing countries women play a significant role in agriculture [8]. Gambian women carry out 60–80% of all agricultural work including food production and processing [36]. The role of Gambian women as cash earners in gardening has also increased [66].

Today, 60% of women farmers in The Gambia produce all the horticultural crops for the domestic and export market; and an increasing number are getting involved in peanut and cotton production [1, 2, 20, 30].

Women own and manage about two-thirds of the country's sheep, half of the goat production and almost all of the poultry population. However, only 4% of their labour is mechanized and the hand hoe remains the basic tool. It is likely that if the taboo against women using animal traction is lifted, they would do even more [1, 2].

EXTERNAL PRESSURES ON AGRICULTURE

From 1968 and into the 1990s, the country witnessed recurrent episodes of drought and erratic rainfall. These episodes accelerated by a high population growth rate of 4%, adversely affected agricultural resource and productivity [6, 59].

Deforestation and loss of topsoil by erosion also became a prominent environmental problem. Land degradation was more pronounced in the rural areas where it was exacerbated by environmentally stressful agricultural practices like slash and burn, fires, overgrazing and uncontrolled tree felling to feed the insatiable appetite of the urban areas for fuel wood [6, 40, 59, 73].

Farmers responded to declines in rainfall, crop yields and revenues by intensifying land use. They reduced the fallow period in peanut cultivation from 7 years to less than 2, and at times eliminated it. They also began using fertilizers and pesticides more extensively to counteract the poor yields and increased pest infestations brought in by drought [12, 47].

Successive years of drought combined with a fall in the market price for peanuts during the 1980s triggered the outward migration of rural youths to the point that it created a shortage in farm labour. By 1985, youths began leaving the rural areas in larger numbers, alleging that returns from farming are declining [73].

Education has also helped to change attitudes of rural youths to farming and many are now indifferent to agriculture. The rapid growth of the hotel and tourism industry has provided farmers with income sources outside the farm, thereby reducing their dependence on it [6, 73].

AGRICULTURAL POLICIES

Prior to 1975, the agricultural policies of The Gambia were concentrated on consolidating those initiated by the colonial government, while those of the post-independence era were geared mainly toward institution building [1, 2].

The period of the Economic Recovery Programme (ERP) and the Programme for Sustained Development (PSD) that succeeded it in 1990 brought quite a number of agricultural policies for the country [43]. A discussion of all the policies is beyond the scope of this paper but a salient few are worthy of mention.

Under ERP, government control on rice and other foodstuff prices were lifted to promote agricultural production. The fertilizer market was also liberalized in 1986. Prior to this, fertilizers were imported by the government and sold to farmers through The Gambia Produce Marketing Board (GPMB) and The Gambia Cooperative Union (GCU) at highly subsidized prices. Most of the fertilizer found its way out of the country as private traders found a more profitable market for it in neighbouring countries [1, 2, 20, 32, 33, 35].

Agricultural policies under PSD opted to diversify agricultural production by promoting horticulture, poultry and cotton farming. The policies emphasized improving access to agricultural inputs; rural credit; increasing self-sufficiency in food production by low cost technology; improved techniques for coarse grains and improving access of women farmers to land [1, 2, 20, 74].

However, policy documents describe the 1980s–1990s as a period of stagnation for Gambian agriculture. Some argue that yields per acre for the major crops have not changed. Production has failed to increase and rural youths abandon the farm to migrate to urban settlements as soon as they reach employable age. This means that the same number of farmers are cultivating the same amount of land and getting the same output [20, 50].

An examination of the underlying causes for this stagnation presents two contrasting images. One image contends that policy documents often convey the ideology that efforts by Gambian farmers to increase production are stifled by lack of improved technology, limited access to credit, poor soil, land tenure and scarcity of farmland. This infers that availing farmers with improved technology, liberal lines of credit and cheap agrichemicals are possible solutions to the problem [3, 20].

The other image purports that agriculture in The Gambia has become risky because the government is no longer providing subsidies, and rainfall has decreased. With animal traction, farmers can now do farm work in less time and release their labour to non-farm work. Non-farm jobs provide farmers with income that reduce their risks from drought. All these factors have resulted in farmers producing the same amount of food [3, 20, 50].

Rather than accepting the concept of stagnation, some experts contend that a “silent transformation” has occurred in Gambian agriculture; claiming that the modest increases in productivity are due to animal traction, agricultural inputs and tractors [20, 58].

Although there has been no dramatic increase in yields per hectare, the indicators are that if resources are channeled where Gambian farmers have demonstrated their interest, the potential for an improved agricultural economy is real. Farmers have shown their capacity to change and adapt external conditions; and if the potential for agricultural development is brighter than before, they would act on it. With the right policy, Gambian agriculture will transform the same way as it has done in other countries [3, 20, 50].

IMPACT ON HEALTH

An understanding of health and safety in agriculture requires an understanding of how agriculture is practiced. From what has been described, it is evident that farming in The Gambia is still labour intensive. Although the *Sine Hoe* and motorized equipment now feature in Gambian farms, agriculture is still largely unmechanized and many farm tasks are performed physically or manually. When farm work is performed with hand tools, heavy materials hand lifted, hand carried or head-loaded for long distances, especially by women, risks for musculoskeletal problems, chronic neck and back pains result.

Gambian farmers are exposed to heavy dust and smoke inhalations during farm work such as clearing and burning fallow land, burning vegetable crop residue and threshing and storing of small grains. Such exposures are likely to trigger respiratory and other types of diseases that remain unrecognized as job-related. The fact that dangerous agrichemicals are handled by illiterate farmers with no personal protective equipment means that allergic or irritant skin reactions and acute and chronic agrichemical intoxications are also risks.

Work with draught animals in The Gambia is risky. The animals are bigger and stronger than humans but are not provided with restraints. Oxen are not dehorned; farmers have to work closely with draught animals to perform their work; and the behaviour of the animals is unpredictable, especially when overworked or tired. Factors like weather vagaries, drought, hurrying to complete a task in a rain fed agriculture with a short rainy season, and the uncertainty of a profitable harvest put farmers in a state of anxiety that render them prone to injuries and the development of psychiatric problems.

Judging from these few scenarios, it is justifiable to say that farmers in The Gambia are exposed to an array of unrecognized hazards and adverse health conditions that need further epidemiological investigations.

Acknowledgements

This study was funded by the University of Iowa's Center for International Rural and Environmental Health, through the NIH Research Grant #D43 TW0621, funded by the Fogarty International Center, NEIHS, NIOSH and ATSDR. Support from Iowa's Center for Agricultural Safety and Health is recognized. The authors are also grateful to Gambian agriculturalists for their support.

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