III

Kenya's Pyrethrum Value Chain Analysis: Executive Summary

Pyrethrum is Kenya's fourth largest cash crop and the country has been the world's number one producer for decades. Nevertheless, the country has seen a dramatic decline in pyrethrum production over the years (in 1992/93 Kenyan production was at 18,000 tons whereas today it is at 12,000 tons). Our report highlights the key distortions in this sector that have led to dwindling production of pyrethrum, despite the crop being the most profitable one compared to other commonly grown crops. Three key layers of inefficiencies emerge out of our analysis:

- *The farmers have least support in financing and quality inputs when it most matters – during the first stage of the product lifecycle.*
    - The first year of a three-year lifecycle of growing the pyrethrum plant is the most crucial one that determines the future profit levels of farmers; in fact, the genetic composition of the planting material contributes to as much as 90% of the pyrethrum content of the dry flower, which is the major profit driver. Therefore, it is crucial for pyrethrum farmers to have access to competitively priced, high quality planting material at the outset. One of the major problems is that the institution specifically designed for this purpose, the Pyrethrum Board of Kenya (PBK), is seriously inefficient and corrupt, which has led to a break down in the supply chain for quality inputs.
    - At the same time, more than half of all the costs of pyrethrum farming are incurred in the first phase of planting material and fertilizer purchases. Farmers' financing needs at this stage are critical and yet very little addressed by Kenyan financial institutions, if at all.
    - As a result, the overwhelming response of the farmers has been to improvise: for the lack of better one, the split their own plants and use it as planting material which gives increasingly inferior yields per
- *One third of the entire cost pyrethrum farming is administrative costs.* These costs take the form of payments to union commissions, taxes, etc., all of which have no clear benefit to the farmers.
- *Farmers are denied the full revenue benefits coming from the market prices of their crop. Just like the case with coffee producers.* Pyrethrum farmers are required by law to market their crop through a central board structure with multiple marketing agencies. Although this design brings supply chain efficiencies for farmers, this structure is taking major chunks of profits from them in the form of various fees and charges of around 10% of the sales price.

A very illustrative example of the burden imposed by these inefficiencies is that the cost of purchasing pyrethrum extracts from Tanzania to Kenya is 6.6% lower than purchasing it from the pyrethrum board domestically – even after all transfer costs to purchase pyrethrum in Tanzania, which is then trucked to Uganda for refining, from where it is flown to Paris and then trucked to a refining facility in Germany, and then flown back to Kenya.

1.0 Kenya's Pyrethrum Sector

1.1 Background

Pyrethrum is Kenya's fourth largest cash crop and the country has been the world's number one producer. The production of pyrethrum peaked in 1992/93 when Kenya produced over 18,000 tons. Since then, corruption, competition from synthetics, poor farming conditions, competition from new market entrants, and other factors have dwindled Kenya's leadership position to the point where production reached a low of 7,000 tons per annum.

Even with the dramatic decline in production, Kenya continues to hold on to a leadership position in the world pyrethrum market, commanding between 60 – 70 percent of the world's market share (Tasmania: 20%; Tanzania: 8%; Rwanda: 5%; and Papua New Guinea: 2%). Kenya's dominate position in the world pyrethrum market is reflected in the fact that virtually all pyrethrum produced in Kenya are exported, with only 3% sold to local manufacturers of pyrethrum based products. This disproportionate market distribution indicates the low level of local value added that currently takes place in the pyrethrum market in Kenya.

2.0 Pyrethrum Processing

Pyrethrum flower is dried and processed into an extract or powder, which are called pyrethrines. These concentrates are generally sold overseas for use in insecticide formulation, as well as for a number of consumer products. Key markets for Kenyan pyrethrum is the United States (60% – 70%), EU (25%), Australia (4%), and Asia and the Middle East (5%). The principal use for pyrethrum in the U.S. market include: pre-and post-harvest sprays for foodstuffs; intestinal parasite control in livestock; shampoos (pets and human) and insect sprays.

Since 1940 when synthetic pyrethrines were introduced, over 50 different pyrethroids have appeared in the market, creating competitive pressure on natural pyrethrum. This trend, however, is now beginning to experience a shift as international standards are creating renewed interest in natural pyrethrum, particularly to reduce the maximum residue levels (MRLs) in consumable products.

Kenya's climatic conditions are ideal for growing pyrethrum, particularly in the upper and lower highlands (1,500 – 3,000 meters above sea level) where there is average rainfall, good drainage and high soil fertility. As such, smallholder farmers, especially in the Rift Valley, Central and Nyanza, have tended to adapt their farming activities to pyrethrum farming. Currently, it is estimated that over 200,000 smallholder farmers are involved in pyrethrum farming in Kenya. One compelling reason for the involvement of so many smallholder farmers in pyrethrum farming is that as a cash crop, the profitability of pyrethrum is substantially higher than other crops commonly grown by farmers in these regions. Specifically, when compared to maize, profitability from farming pyrethrum is 4 times higher, as reflected in Table 18.

Table 18: Profitability Index for Selected Cash Crops

Cash Crop	Profitability Index
Maize	100
Green peas	57
Potatoes	270
Pyrethrum	411

The following matrix provides a snapshot of the pyrethrum sector in Kenya (Table 19).

Table 19: Kenya's Pyrethrum Sector Profile

1.0 Market Demand	
1.1 World market for pyrethrum-based pesticides	$400 million
1.2 Product demand (dried pyrethrum flower)	20,000 tons
1.3 Current production level (dried pyrethrum flower)	12,000 tons
2.0 Principal Producers Worldwide[36]	Kenya, Rwanda, Tanzania, Tasmania, Papua New Guinea, Ecuador, India, Uganda, and Chin
3.0 Principal Buyers	United States (75% of world supply)
4.0 Competition	Over 50 synthetic pyrethroids available in the market, principally produced by Japan
5.0 Principal Use	Pre-and post-harvest sprays for foodstuffs, intestinal parasite control in livestock, shampoo (pets and human), insect sprays
6.0 Principal Producers: Kenya	
6.1 Number of farmers	200,000 smallholders
6.2 Farm size	< 1 acre
6.3 Total area under cultivation	26,000 ha
6.4 Growing areas	Rift Valley, Central and Nyanza Provinces

Source: Global Development Solutions, LLC™

3.0 Pyrethrum Value Chain

A principal challenge in conducting a value chain analysis for pyrethrum is that the life cycle of the plant is at least three years during which the largest costs (investments in planting material) are incurred during the first year, while the peak harvest occurs during the second year when there is limited input costs. By the third year, the yield rate begins to decline.

While some farmers may elect to keep the plant intact even after the third year, plant disease and declining yield rates make it uneconomical to extend the plant cycle for more than 3 years.

A value chain for pyrethrum farming can be divided into 6 distinct categories: land preparation; planting; plant maintenance; harvesting; drying; and administrative costs. For this exercise, a high yield farm was selected where the average annual yield rate for the three year plant cycle is 1,107.3 kg/ha. Based on this yield rate, the cost per kg of pyrethrum flower was estimated to be Ksh 50.25.

The following key assumptions were made for the value chain analysis (Table 20).

Table 20: Key Assumptions

Yield Rate	Year 1	Year 2	Year 3	Average Yield
Kg/ha	864	1,358	1,100.0	**1,107.3**
Average cost Ksh/kg	82.24	36.45	42.17	**50.25**

[36] East Africa accounts for over 90% of all pyrethrum production in the world.

Average Pyrethrum Content	1.559	1.559	1.559	**1.559**
Exchange Rate (Ksh/$)	72			

Source: Global Development Solutions, LLC™

The value chain analysis for pyrethrum used a three year running average, which reflects the average lifecycle of a pyrethrum plant. During the first year, the high cost of planting material and land preparation constitutes over 52% of the overall cost for a single season. Consequently, during the first year, the average cost per hectare to start a pyrethrum farm can be as high as Ksh 71,051.

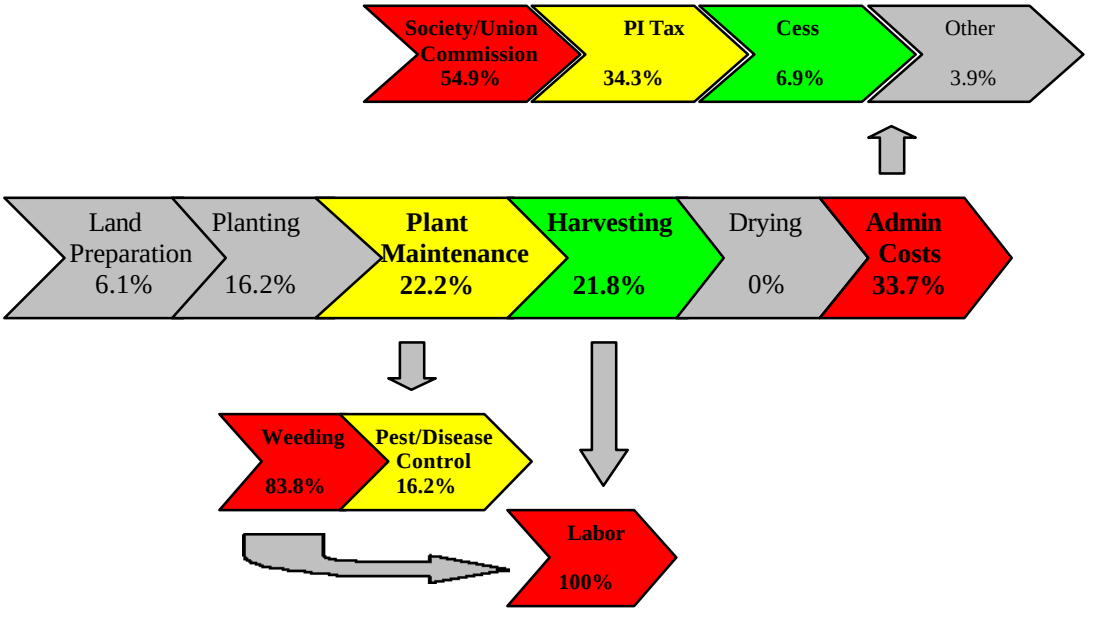
A critical factor during the first year of establishing a new crop is the quality of planting material, proper application of fertilizer (TSP), as well as nematicides and fungicides. Industry estimates suggest that genetic composition of the planting material contributes to as much as 90% of the pyrethrum content of the dry flower, which in turn defines the level of profits enjoyed by farmers.

Interviews with large farmers suggest that a good hybrid (P4) seedling or clonal material cost as much as Ksh 7,700/ha. Currently, the Pyrethrum Board of Kenya (PBK) is responsible for making available high yield hybrid seedlings, but lack of resources resulting from bureaucratic inefficiencies and corruption has made it virtually impossible for local farmers to access competitively priced, high quality planting material from PBK. As a result of this breakdown in the supply chain, farmers have tended to split their own plants, or otherwise borrowed from neighboring farms. As anticipated, consistent use of the same root stock has contributed to disease and increasingly low yields per hectare.

Since the collapse of the Agricultural Finance Corporation, the absence of financial institutions and support for accessing finance has become a critical problem for pyrethrum production, particularly during the initial planting phase. As a result of the lack of financing available to farmers, the use of poor planting material and thus increasingly poor quality and low yields has become a common characteristic of the Kenyan pyrethrum market.

Based on a 3 year running average, the value chain for pyrethrum farming suggests that the single largest cost to farming are the administrative costs. Specifically, over 33.7% of the total cost of farming is accounted for by administrative costs (refer to Diagram 19). Of this amount, 89.2% was for society/union commission (54.9%) and PI tax (34.3%).

Diagram 19: Value Chain for Pyrethrum Farming in Kenya



Source: Global Development Solutions, LLC™

Interviews with growers suggests that there is no clear benefit associated with payments of Society/Union Commission and the PI Tax, nonetheless farmers are required to pay them. Farmers cited that the market environment for pyrethrum farming is much more favorable in Tanzania where farmers are assessed a levy by the Tanzania Pyrethrum Board, which is approximately 10% of the cost of production, depending on the pyrethrum content.

The value chain analysis revealed that the second and third largest value added component for pyrethrum farming is labor for both plant maintenance and harvesting. Previous research on pyrethrum farming has shown that proper use of herbicides, particularly Venzar and Sencor, proved effective in controlling weeds, so much so that it was possible to reduce labor input by over 57%.[37] In most instances, principally due to costs, Kenyan farmers tend to have relatively low application of herbicides such as Venzar and Sencor.

A closer look at pyrethrum farming suggests that labor inputs can range from 47% to as much as 70% of the total cost of farming, particularly if the costs of farming are averaged over the entire lifecycle of a plant. In this context, proper use of herbicides, combined with in-field technical assistance to improve labor productivity are critical factors associated with improving the competitiveness of pyrethrum production.

As indicated by the value chain analysis, no resources are allocated to drying because the high cost of fuel is forcing farmers to rely on the sun for drying their harvest. It is estimated that sun drying requires 3 full days of sunshine combined with a total of half-a-day of labor to rake the flowers for even drying. Blow drying on the other hand costs approximately Ksh 1,000/ton using wood or Ksh 2,000/ton using fuel, both of which brings the moisture content to below 30%. Sun drying, on the other hand, can only achieve a 50% moisture content. Given the

[37] Ngugi, C.W., Ikahu, J.M.K and Gichuru, S.P. (1989). The Effects of Vensar in Weed Control in Established Pyrethrum Fields. Pyrethrum Post 17(2), 52 – 55.

abundance of sun, blow drying does not necessarily offer any efficiency gains, except during periods when the country might have sustained rains during the harvest period.

4.0 Pyrethrum Marketing and Pricing

The Pyrethrum Act, CAP 340 of the Law of Kenya which provides the regulation for the pyrethrum industry requires farmers to sell pyrethrum to PBK, but through one of four marketing vehicles: Farmers' Cooperative Societies (FCS), Self-help Group (SHG), Board Collection Centers (BCC), directly to the PBK or through a broker (Diagram 20). Brokers function as a mechanism to help consolidate production from various smallholder farmers, and in turn channel the flowers through the three marketing agents to PBK.

Once flowers are delivered to the PBK, they are checked for pyrethrum content (referred to as PC Test). The maximum PC is about 3%, and local producers may achieve a maximum of about 2% pyrethrum content. Since flowers oxidize quickly after they have been harvested, the level of PC declines rapidly, which in turn diminishes the profit margin for farmers. Taking into account internal inefficiencies within the PBK, prolonged testing time and subsequent warehousing of stock has contributed to increasingly poor quality of pyrethrum available in the market and poor returns for farmers.

In the past, PBK offered a bonus program for farmers where quality and quantity was rewarded. In 2000, the bonus was as high as 30% of the price of a crop. In 2001, the bonus declined to 3% and as of 2002, no bonuses were offered. In fact, some farmers have not even been paid for the delivery of their harvest.

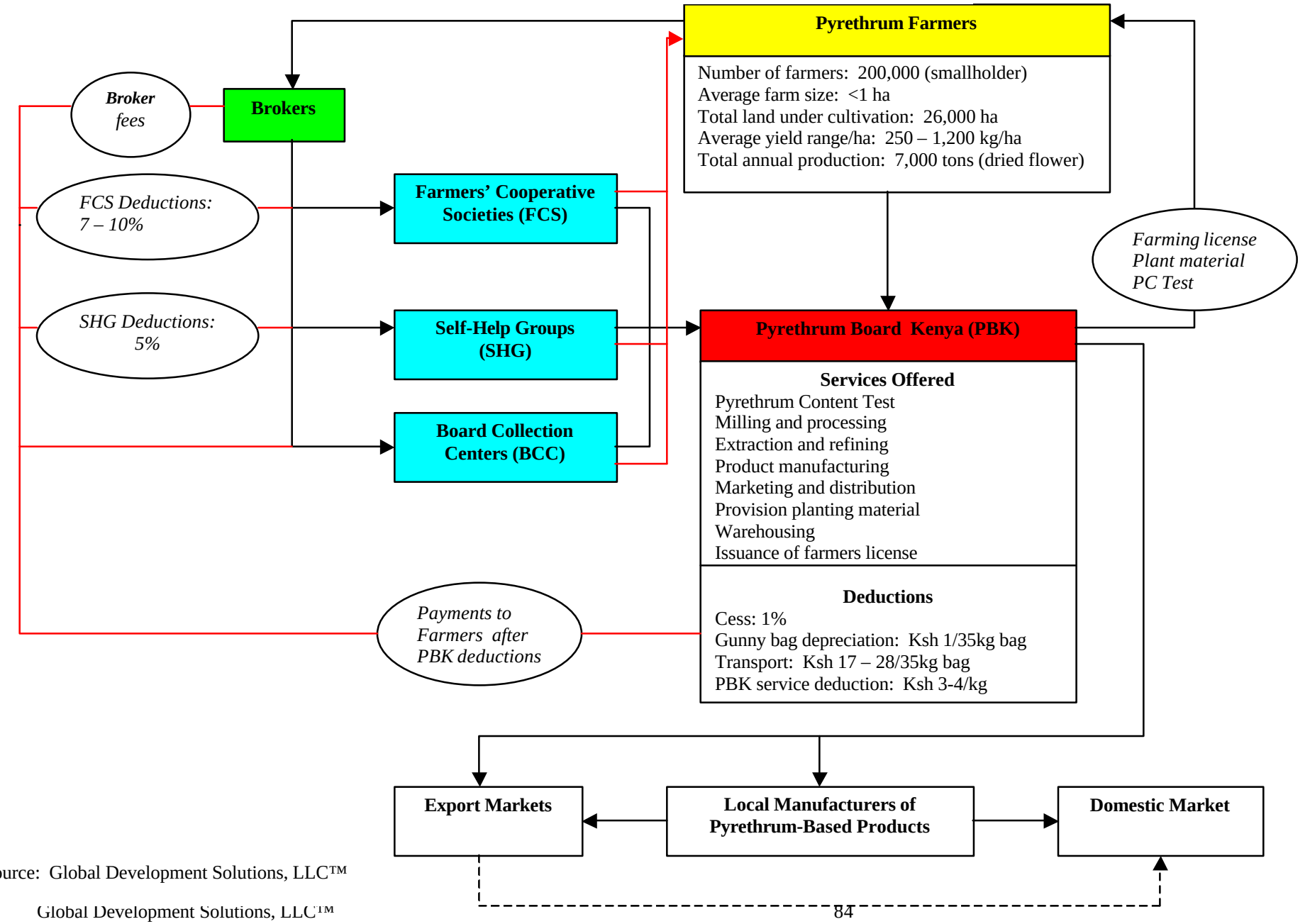
When farmers are paid, the amount farmers receive does not reflect the actual market price due to the substantial deductions imposed by the PBK. These deductions include:

- Cess: 1%;
- Gunny bag depreciation charges: Ksh 1/35kg bag;
- Transport: Ksh 17 – 28/35kg bag; and
- PBK service deductions: Ksh 3 – 4/kg.

Once these deductions are made, proceeds from sales backtrack through the marketing agent who also deducts service charges before funds are released to the farmers. FCS deducts 7 – 10 percent of sales, while SHG deducts approximately 5 percent of sales. In addition, brokers who consolidate harvest from numerous smallholder farmers, also charge for their services. It was not possible to get a firm estimation of brokerage charges.

As indicated in the value chain analysis, administrative costs are excessive and burden farmers to a point where pyrethrum farming is becoming increasingly less attractive for Kenya farmers.

Diagram 20: Kenya's Pyrethrum Market Transaction Flow Map



Source: Global Development Solutions, LLC™

5.0 Pyrethrum Processing: An Example from Mosquito Coil Production

Once pyrethrum flower is dried, it is then milled into powder, which is referred to as a grist. Milled pyrethrum flower is usually stored in 35 kg gunny sacks. Grist as a powder can be used to make various products including mosquito coils. Similarly, grist can be distilled to make a concentrated extract for aerosol sprays, shampoos and other products.

One popular product which is produced by local companies for both the domestic and foreign markets are mosquito coils.[38] In areas where electricity is available, coils have been replaced by vapor patches, but given the malaria problems faced by many African countries, mosquito coils continue to be a popular product.

The value chain for a mosquito coil can be divided into 6 activities: mixing, kneading, extrusion, stamping, drying and packing. The average cost per coil can range from $1.46/coil to $2.03/coil depending on the source of pyrethrum powder.[39] As an example of the inefficiencies facing the Kenyan pyrethrum market, grist sold by the PBK costs approximately Ksh 208/kg, while grist of the same PC available in Tanzania cost about Ksh 105/kg – making Kenyan grist nearly twice as expensive as that produced in Tanzania.

When using pyrethrum powder from Tanzania in the production of Kenyan-produced mosquito coils, the highest value added for the production of mosquito coils is packing (44.2%), mixing (40.7%), and stamping (7.8%). For both packing and stamping, labor input represents the highest cost component for those two activities. In this context, producers cited the need for skills training as an important support activity required to help improve the productivity of the pyrethrum sector.

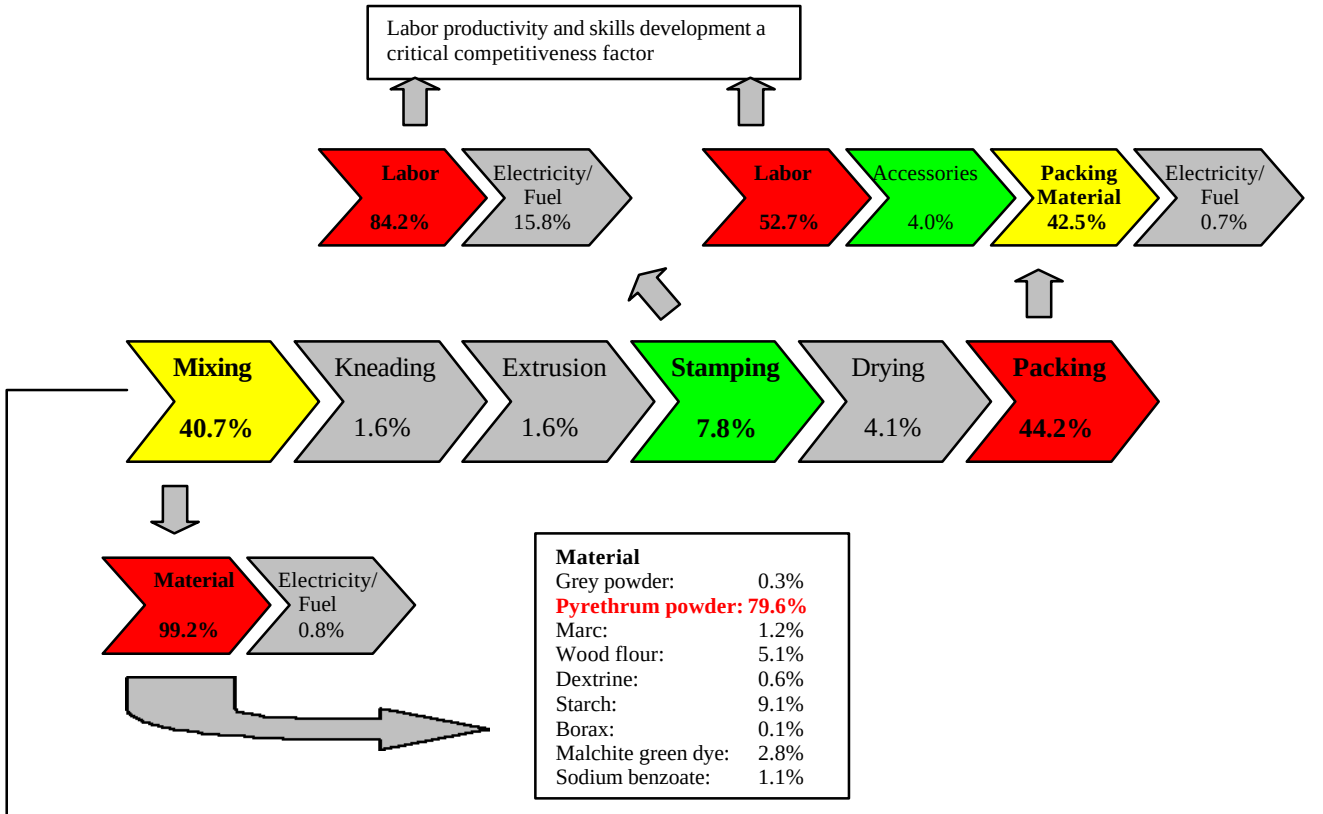
For mixing, 99.2% of the cost is accounted for by the cost of material inputs, which is principally pyrethrum powder (79.6%). This clearly emphasizes the importance of having access to competitively prices, high quality pyrethrum powder for pyrethrum based product manufacturers in Kenya to remain competitive.

As the Diagram 21 and Diagram 22 indicates, using pyrethrum powder from PBK shifts the distribution of cost across the value chain so that mixing becomes the highest cost item (57.5%) and packing (31.7%) and stamping (5.6%) become less relevant in the overall cost of the mosquito coil production.

[38] Production of mosquito coils in Kenya reached 90 million coils in 1996, but by 2001, this figure had dropped to 35 million coils, principally due to the lack of access to competitively priced pyrethrum powder from PBK.

[39] These figures include the proportional cost of a coil stand, plastic wrap, boxes and cartons for packing mosquito coils. On average, one coil stand is allocated for every 10 mosquito coils. In addition, these costs are based on an assumption that there are 10 coils/box and 360 coils/carton.

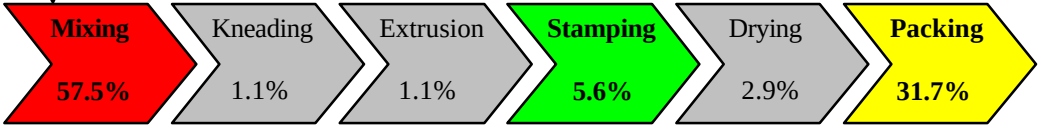
Diagram 21: Value Chain for Mosquito Coil Production in Kenya Using Tanzanian Pyrethrum Powder



Source: Global Development Solutions, LLC™

Principal cost driven by the high cost of pyrethrum powder

Diagram 22: Value Chain for Mosquito Coil Production in Kenya Using Pyrethrum Powder from PBK



Source: Global Development Solutions, LLC™

6.0 Sourcing High Quality, Competitively Priced Pyrethrum: A Critical Problem for the Survival of the Pyrethrum Based Product Industry and Rural Farming

As less and less pyrethrum powder and extract is available through PBK, local manufacturers of pyrethrum based products are under increasing pressure to identify alternative means of continuing business. One local manufacturer has resorted to working with pyrethrum growers in Tanzania to access pyrethrum.

To illustrate the length to which Kenyan manufacturers must go to access pyrethrum extract, one Kenyan company purchases pyrethrum from Tanzanian farmers, which is then milled into a grist, as in Tanzania. From there, the grist is trucked to Uganda where primary extraction takes place. Using air freight, the primary extract is flown to Paris and then trucked to Germany where secondary distillation is undertaken. The extra fine extract is then flown back to Kenya for use in producing aerosols, shampoo and other liquid-based products. This elaborate purchasing and processing scheme is the only channel through which Kenya manufacturers of pyrethrum based products can access enough quality pyrethrins required to hold on to a rapidly declining market share.

The irony of this complex market scheme is that the total cost for the Kenyan manufacturer to purchase pyrethrins using this channel is approximately $319.65/kg, while pyrethrins of lesser quality purchased through the PBK cost $342.02/kg. Even after all of the transport costs, taxes, security and clearing charges, and handling charges to purchase pyrethrum in Tanzania, trucked to Uganda for refining, air freight to Paris and then trucked to a refining facility in Germany, and then flown back to Kenya, the cost of accessing high quality pyrethrins is 6.6% lower than purchasing fine extract from PBK.

Whether purchasing grist or fine extract from PBK, the monopolistic position of PBK[40] that prohibits manufacturers from working with and purchasing directly from pyrethrum farmers is having a detrimental impact, not only on rural farmers and their livelihood, but also on the future survival of the pyrethrum sector in Kenya. As the above example illustrates, as increasing number of Kenyan manufacturers begin sourcing pyrethrum from Tanzanian farmers, this will have a clear and immediate impact on pyrethrum farmers in Kenya. Similarly, prevailing market conditions may accelerate this pattern of purchasing where future investments in the Kenyan pyrethrum sector shifts to neighboring countries.

7.0 Other Market and Policy Impediments to Growth and Competitiveness in the Pyrethrum Sector

Pest Control Products Board (PCPB): In addition to the market constraints imposed by the monolithic structure of the PBK, local manufacturers also cite problems associated with the Pest Control Products Board (PCPB) as yet another barrier to competitiveness of the pyrethrum sector. Specifically, as PCPB regulates the registration and approval of new pest control products, local manufacturers cite the slowness of the PCPB in responding to requests for new registration of pyrethrum based products. The prolonged trial period imposed by the PCPB discounts whatever competitive edge that a Kenyan manufacturer might have in introducing a new product line.

Restrictive Tax Structure: As mentioned in other sections of this report, the tax regime imposed by the Kenyan Government continues to favor importation rather than

[40] It was recently announced that the PBK Board will now have direct participation by key players from the private sector. This move is seen as a positive step forward, and provides an encouraging signal for further liberalization of the sector.

local value added. This is the case even in the pyrethrum sector. In the case of pyrethrum-based aerosol sprays, pyrethrines is the principal active ingredient, but taxes on imported input material to fabricate the aerosol can is so restrictive that imported pyrethrum-based aerosol sprays are cheaper than locally produced pyrethrum sprays. Specifically, the following duties are imposed on input materials to fabricate an aerosol can:

- Tinplate: 25%
- Cones/domes: 15%
- Valves/actuators: 10.5%
- Inks/varnish: 25%
- Copper: 15%
- VAT: 15%

While these duties are imposed on imported material to fabricate an aerosol can, the Kenyan Government imposes a 5% duty and no VAT on imported finished aerosol products. This discrepancy in the tax structure clearly discourages local value added and local formulation of products by Kenyan manufacturers.

Summary of Constraints Faced by the Pyrethrum Sector in Kenya

Policy Based Distortions	Market Based Distortions
Strategic choice by PBK to sell pyrethrines to export markets rather than to sell pyrethrines to local manufacturers to enhance Kenyan value added production	Competitive pressure from synthetic pyrethrines
High society/union commission with little benefit to farmers	Poor access to high quality, competitively priced planting material due to the monopolistic position of the PBK as the sole source of planting material
High PI tax with no benefits for farmers, particularly as farmers have not been paid for their harvest	High cost of fertilizers/herbicides combined with poor access to working capital reduce the use of fertilizers, which in turn reduces per hectare yield rates
Corruption and collapse of the marketing structure for transfer of harvest from farmer to PBK	Low labor productivity, particularly on-farm labor skills are low as extension services have generally been poor or non-existent
Nonpayment to farmers by PBK	High deductions by marketing agents who generally provide inadequate or substandard quality service
Elimination of the bonus structure to reward high quality	High administrative costs, particularly with regards to various charges imposed by PBK
High PBK deductions for services which are not rendered properly	Inadequate technology and capacity forces PBK to warehouse grist, which quickly oxidizes; quality is compromised and revenues for the farmers are lowered
Inefficiencies of the PBK increase the cost of grist by 98% compared to competitors in Tanzania and Tasmania	
Uncompetitive pricing for pyrethrines offered by PBK due principally to corruption and the lack of internal efficiencies	
Monopolistic market structure of PBK results in market inefficiencies and uncompetitive pricing	
Restrictive registration process imposed by PCPB dampens competitiveness of pyrethrum based product manufacturers	
Restrictive tax policy which favors imports and provides virtually no assistance to encourage local value added production	

Source: Global Development Solutions, LLC™