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KENYA HORTICULTURE COMPETITIVENESS PROJECT

PULSES VALUE CHAIN ANALYSIS

Case Study of Dry Land Seed Company (DLSC), Four Year Analysis (2010-2013)



September 2013

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Executive Summary

In October 2010, Dry Land Seed Company (DLSC) partnered with the USAID-funded Kenya Horticulture Competitiveness Project (USAID-KHCP) to commercialize the production and sales of certified crop seeds adaptable to dry conditions. As a result:

- The introduction of new, high-yielding seed varieties through demonstrations, field days, and linkages with agrodealers led to significant increases in production volumes. The highest production was achieved in 2013 in both quantity and value as indicated by 223.4 MT worth Ksh 14.5 million (\$168,389).
- The pulse market is dominated by beans, constituting 44 percent of the overall volume, followed by Cowpeas at 37 percent. Common bean varieties grown are; KAT/B-1 (Katumani Bean 1), KAT/B-9 (Katumani Bean 9), KAT X56 and KAT X69.
- The low volume of pigeon peas produced is linked to household consumption. Green/fresh pigeon peas constitute 75 percent of the production. In Kitui and Machakos counties, the produce is usually sold through informal channels making it difficult to capture the actual sales. The introduction of medium duration pigeon pea varieties, which are good for the green pods, has significantly reduced production of the dry seed.
- Nationally, bean production increased by 15 percent from 2011 to 2012, from 577,674 metric tons (MT) to 662,240 MT, with highest volumes in Eastern and Central counties
- Pulses in Eastern province are considered a woman's crop, as indicated by 63 percent in gender contribution. Most men concentrate in livestock keeping, which is considered a male activity in the society. The 37 percent male contribution is associated to male participation in seed production in Machakos and parts of Makueni County. The continuous increase in the number of growers is associated with the improved prices hence higher income.
- The introduction of new varieties from DLSC and local agrodealers resulted in increased adoption rates and diversification from smallholders. About 63 percent of farmers were found to grow more than one pulse type. Green gram recorded the largest adoption rate, with 282 new farmers planting the crop between 2010 and 2012.
- Overall, the area under pulse production increased by 72 percent, from an average of 1.12 acres to 1.93 acres per farmer. Beans occupy the largest acreage due to high gross margins; pigeon pea was least profitable, resulting in the least acreage and lowest adoption.
- The percentage of farmers earning above Ksh 50,000 from pulse sales increased by 14 percent in 2013. Those earning below Ksh 10,000 reduced from 88 percent to only 22 percent and is attributed to the increased adoption of the new improved seed varieties.
- Machakos county lead in sales due to the diversity of pulse type being grown. This is attributed to more suitable climatic conditions mainly the higher rainfall for beans, cowpeas and green grams. Competition with other products such as wheat and barley in Narok, and export peas in Taita Taveta, has pushed the pulse production into marginal areas, like Mwatate in Taveta County. This significantly reduces the area and yields.
- All the pulses produced were profitable, with beans ranking first, followed by green gram, cowpeas, and pigeon peas.

I. Introduction

Dry Land Seed Company (DLSC), a limited liability private company established in 2004, produces and sells crop seeds adapted to dry-land conditions. They have a main office and seed processing plant in Machakos, from where they support and distribute seeds throughout the Eastern Region. The seeds are developed in cooperation with the Kenya Agricultural Research Institute (KARI) through a public-private partnership licensing agreement. All seeds are certified by the Kenya Plant Health Inspectorate Service (KEPHIS). DLSC has a retail store in Machakos, but the majority of seed sales are to four major agrodealers who, in turn, distribute to their stores throughout the region.

Improved seed is a costly input and rare in non-commercial crops. This is especially true in the case of pulse seeds, where there remains a large gap between supply and demand. This problem is further accentuated by the low seed multiplication ratio in pulse crops. Unless enterprising progressive farmers, agrodealers, and NGOs come forward to take up seed production, this situation is likely to remain unchanged. The quality of seed used by farmers determines the status of agriculture they practice. However, for maximum gain in productivity in any crop, use of both improved varieties and improved integrated crop management practices are required.

There is need to train a network of rural stockists that can supply certified pulse seed and other inputs to farmers. Many of the stockists, where available, do not have knowledge of improved pulse seeds. Consequently, they are unable to provide farmers with credible information on seed-related issues such as available varieties, simple agronomic practices, and agro-ecological adaptability of different pulse varieties. To solve this problem, the stockists need to be trained to develop their technical, product, and business management skills. Agrodealer/stockist capacity building is critical to the development of well-functioning seed markets because they provide farmers with information they need to boost their yields. These men and women are foot soldiers in the transformation of the regional agriculture. These skills will help them to stay focused on their clients, grow their businesses, and build momentum towards achieving seed accessibility and security in the region.

In 2010, USAID-KHCP entered into a formal partnership agreement with DLSC to enhance access to quality seed and make sure that farmers in the whole of lower Eastern region (Mwingi, Kitui, Machakos, and Makueni counties) have the opportunity to increase their production and income. The partnership focused on developing a certified seed system to replace the existing informal systems, which often result in impure seeds with unknown origins, inconsistent supply to smallholders, and limited geographic reach.

By end of the partnership in September 2013, the company had launched and introduced five new improved varieties. The company has invested in new technologies such as integrated pest management (IPM) and has been able to add technical personnel to work directly with farmers.

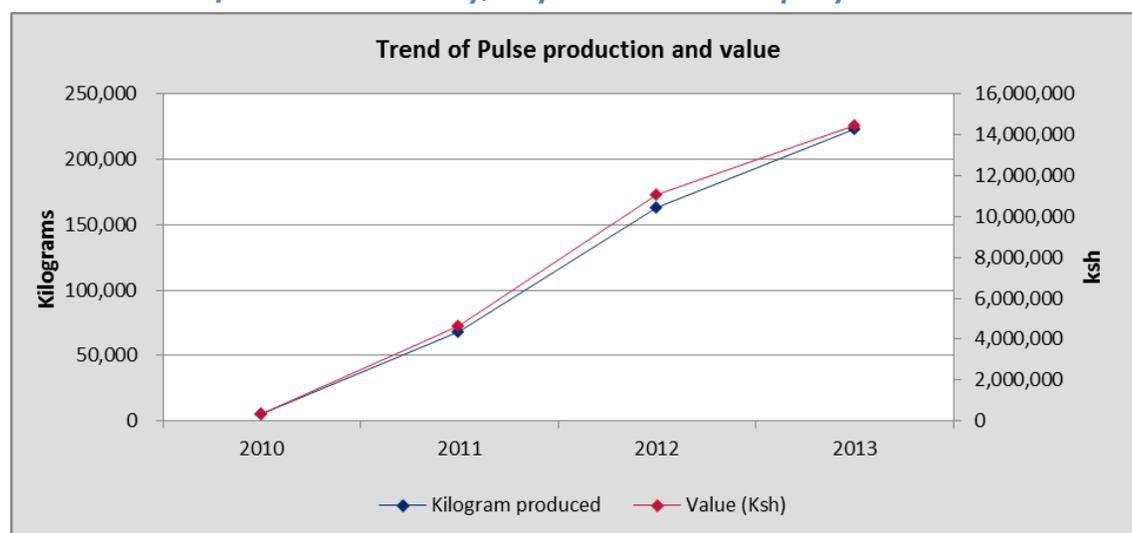
2. Three-Year Analysis of Pulses Productivity Data

Pulse production has consistently increased every year in lower eastern since 2010, with overall sales volumes increasing from a low of 5.6 MT in 2010 to 223.4 MT in 2013. This is due to the concerted effort by the project to introduce new high-yielding varieties of the three pulses through demonstrations, field days, and linkages with agrodealers. More farmers now have access to seed.

2.1 Pulse Productivity

Pulse productivity					
Year	2010	2011	2012	2013	Total
Production (kg)	5,576	68,408	163,353	223,404	460,741
Value (Ksh)	360,356	4,680,769	11,114,068	14,450,812	30,606,005

2.2 Trend of Pulse Productivity, Dry Land Seed Company



*Note kilograms on left axis, Ksh on right axis.

- Much of the increase in volume is due to farmers leaving local varieties in favor of the new, improved seeds from DLSC.
- The pulse market is dominated by beans, constituting 44 percent of the overall volume, followed by Cowpeas at 37 percent. Common bean varieties grown are: KAT/B-1 (Katumani Bean 1), KAT/B-9 (Katumani Bean 9), KAT X56, and KAT X69.
- DLSC concentrated on beans, cowpeas, and green grams for seed production, especially in Machakos County, resulting in higher figures for these three crops. The lower volumes for pigeon peas recorded is also linked to home consumption or informal market channels (i.e. road-side vendors), making it difficult to capture the data (ICRISTAT). Introduction of medium maturing Pigeon pea varieties, which are good for the fresh green pods production, has significantly reduced the harvesting of the dry seeds. These are easily captured through export.
- Machakos County leads in beans, green gram and pigeon pea production. On the other hand Kitui ranked first in Cowpea production. The common cowpea varieties grown are Machakos 66 (M66), Katumani 80 (K80), KVU-419 and KVU 27-1.

2.3 Productivity by Pulse Type

	2010	2011	2012	2013	Total
Kilogram produced					
Bean	3,172	31,829	58,665	109,504	203,169
Cowpea	2,383	16,469	48,282	105,373	172,506
Green gram	21	15,075	38,624	8,527	62,247
Pigeon pea		5,036	17,783		22,819
Total	5,576	68,408	163,353	223,404	460,741
Value of production					
Bean	215,696	2,164,355	3,989,186	7,446,272	13,815,509
Cowpea	142,980	988,110	2,896,890	6,322,380	10,350,360
Green gram	1,680	1,206,000	3,089,880	682,160	4,979,720
Pigeon pea		322,304	1,138,112		1,460,416
Total	360,356	4,680,769	11,114,068	14,450,812	30,606,005

2.4 County Performance by Pulse Type

Value of production (Ksh) by County					
	2010	2011	2012	2013	Total
Bean	215,696	2,164,355	3,989,186	7,446,272	13,815,509
Kitui		62,220	53,788		116,008
Machakos	182,376	1,986,875	3,918,194	2,696,744	8,784,189
Makueni	33,320	115,260	17,204	869,856	1,035,640
Taveta				238,272	238,272
Narok				3,641,400	3,641,400
Cowpea	142,980	988,110	2,896,890	6,322,380	10,350,360
Kitui	14,100	93,900	565,620	2,900,520	3,574,140
Machakos	71,280	535,140	1,232,550	466,140	2,305,110
Makueni	57,600	359,070	1,098,720	1,570,320	3,085,710
Tharaka Nithi				1,385,400	1,385,400
Green gram	1,680	1,206,000	3,089,880	682,160	4,979,720
Kitui		495,200	812,080		1,307,280
Machakos	1,680	280,560	1,588,920		1,871,160
Makueni		430,240	688,880	682,160	1,801,280
Pigeon pea		322,304	1,138,112		1,460,416
Machakos		288,128	831,872		1,120,000
Makueni		34,176	306,240		340,416
Total	360,356	4,680,769	11,114,068	14,450,812	30,606,005

3. Target Areas of Pulse Production

Beans

All the varieties can be grown in various agro-ecological zones of semi-arid areas, as they are more drought tolerant than Mwezi Moja (GLP 1004). Katumani Bean 1 performs well in areas between 900-1600m above sea level, but at elevations higher than 1600m above sea level, angular leaf spot and halo blight may seriously affect its yields. KAT Bean 1 does not do well in areas with high rainfall. Katumani Bean 9 is suitable for cultivation in lower altitude areas of 1000m and below where the average rainfall season is more than 200mm. The four varieties are sensitive to Waterlogging and acidic soils. Their optimum temperatures range from 15°C - 27°C. KATX69 also do well in cold dry highland areas especially in Nanyuki. Reduced growth is observed with low temperatures and very high rainfall. KAT X56 does well in ASAL areas of Nyanza (Bondo and Siaya).

Cowpeas

Machakos 66 is recommended for medium and higher altitudes of between 1200-1500 above sea level in agro-ecological zone III and IV. KVVU 27-1 performs well in similar agro-ecological zones as Machakos 66. Katumani 80 is recommended for drier agro-ecological zones IV and V or areas below (1500m above sea level receiving an average of 200mm rainfall per season).

KVVU 419 is recommended for cultivation in areas below 1200m above sea level receiving less than 200mm of rainfall per season. These are agro-ecological zones IV and V in lower Kitui, Mwingi, Makueni, Tharaka, Tana River districts, and Yatta plateau in Machakos districts.

Green gram

Variety: N26 or KVR 26 (KAT/MB26 Katumani mung Bean 26), N22 or KVR 22 (KAT/MB22 Katumani mung bean 22)- The two varieties of mung bean are recommended for cultivation in both semi-arid and well-watered areas of between 50-1600m above sea level. N22 thrives best in well-drained sandy loamy soils and because of its lateness and performance in the drier areas is relatively poor. N26 is suited to well- drained sandy loams and because of its earliness it has proved more successful in the drier areas of lower Machakos, Kitui, Mwingi, Tharaka, Mbeere and Makueni districts. At elevations of more than 1800m above sea level, it has very poor pod set.

Pigeon pea

Varieties; KAT 60/8 (KAT/PP 60/8), Mbaazi-1 and Mbaazi-2-Pigeonpea varieties are sensitive to differences in temperature, with late maturing types, high temperatures (greater than 20°C) delay maturity whereas in the early types higher temperatures (20-30°C) hasten maturity. KAT 60/8 can be grown between 50-1800m above sea level and performs well in lower Makueni, Kitui, Mwingi, Mbeere, Tharaka, Meru and Machakos where temperatures are high.

Mbaazi-1 can be grown in the same range of altitude and temperature as KAT /60/8 but is better suited to the more humid coastal zone. Mbaazi-1 is better adapted to medium and higher altitude (over 900m above sea level). If grown in altitude lower than 900m above sea level, they produce excessive growth and may not flower

4. National Production of Major Pulses in 2010-2012

Commodity	2010	2011	2012	2010	2011	2012
	Area (Ha)	Area (Ha)	Area (Ha)	Quantity (MT)	Quantity (MT)	Quantity (MT)
Beans	689,377	1,036,738	1,065,180	390,598	577,674	662,240
Cowpeas	168,273	197,980	218,851	72,274	81,534	117,743
Green Grams	147,352	159,910	188,493	61,248	70,225	90,702
Pigeon pea	158,746	138,708	143,212	103,234	84,313	89,390

Source: Kenya food security report Ministry of agriculture March 2013 and Economic review of agriculture 2011 & 2013

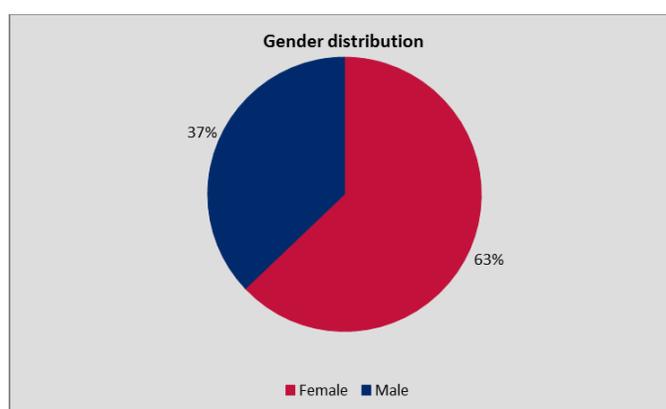
- Nationally, bean production increased by 15 percent from 2011 to 2012, from 577,674 metric tons (MT) to 662,240 MT, with highest volumes in Eastern and Central region counties.
- Food security interventions by the ministry such as *Njaa Marufuku Kenya*, NAIAAP, and traditional high value crops are making an impact among smallholder farmers who can now access certified seeds and fertilizers as well as diversify the food crops by planting drought tolerant crops of green grams, cowpeas, pigeon peas among others.

4.1 National Seed Requirements as of 28th February 2013

Crop	LR Targeted (Ha)	Seed demands (kg)	% formal seed	Formal demand (kg)
Beans	749,044	56,178,300	2	1,123,566
Green Grams	113,128	2,217,309	1	22,173
Cowpeas	134,714	2,640,394	1	26,404
Total	996,886	61,036,003	2	1,172,143

Source: Kenya food security report Ministry of agriculture March 2013

5. Overall gender distribution



- Pulse production in lower eastern counties is considered a woman crop, and thus the 63 percent gender participation. Most men concentrate in livestock keeping, which is considered a male activity in the society. The 37 percent male contribution is associated to male participation in seed production in Machakos and parts of Makueni Counties.
- When the value of the product increases, men often come in to control the sales, production, and distribution of a crop. This would explain the growing numbers of male producers as prices increased.

5.1 Gender Breakdown by Pulse Type

Variety	2010		2011		2012		2013	
	Female	Male	Female	Male	Female	Male	Female	Male
Bean	23	13	217	246	240	117	133	91
Cowpea	17	12	224	124	303	118	135	63
Green gram	1	2	143	90	191	91	36	14
Pigeon pea	0	0	74	13	116	22	0	0
Total	41	27	658	473	850	348	304	168

6. Pulse Adoption

- The introduction of new pulse varieties, training, and technical assistance coupled with improved market linkages resulted in increased adoption by farmers, ultimately resulting in higher incomes. Some farmers abandoned other economic activities that were less profitable to adopt pulse farming.

Pricing

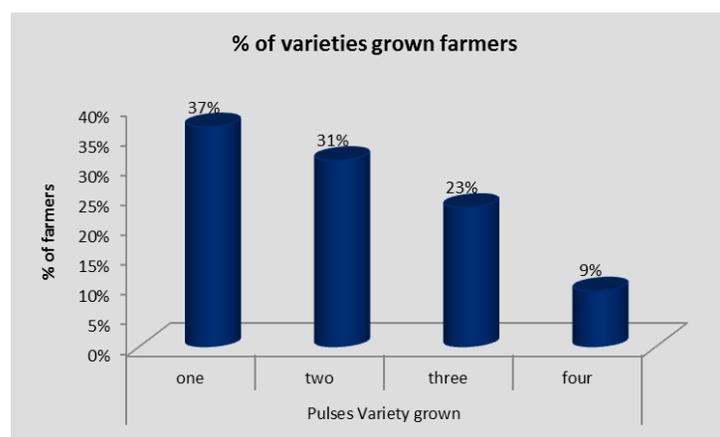
Average wholesale prices (Ksh) per Kilogram				
Variety	2010	2011	2012	2013
Bean	52	55	58	61
Cowpea	44	66	77	79
Green gram	76	99	90	82
Pigeon pea				89

Source: Ministry of Agriculture, Market Information Office, and East Africa grain Council. Compiled by USAID-KHCP

6.1 Percentage of Farmers Growing Multiple Pulse Types

Number	Number of Pulse Types Produced				Total
	1	2	3	4	
Growers	360	305	228	91	984
%	37%	31%	23%	9%	100%

- The introduction of new varieties from DLSC and local agrodealers resulted in increased adoption rates and diversification from smallholders. About 63 percent of farmers produce more than one pulse type, and only 37 percent produce only one type.



6.2 Overall Farmers by Pulse Type

Variety	2010	2011	2012	2013
Bean	36	463	357	224
Cowpea	29	348	421	198
Green gram	3	233	282	50
Pigeon pea	0	87	138	0
Total	68	1,131	1,198	472

- There has been substantial growth in the number of growers producing each type. Green gram recorded the largest adoption rate from 2010-2012 with 282 farmers, of which majority were female.

6.3 Farmer Trends by County

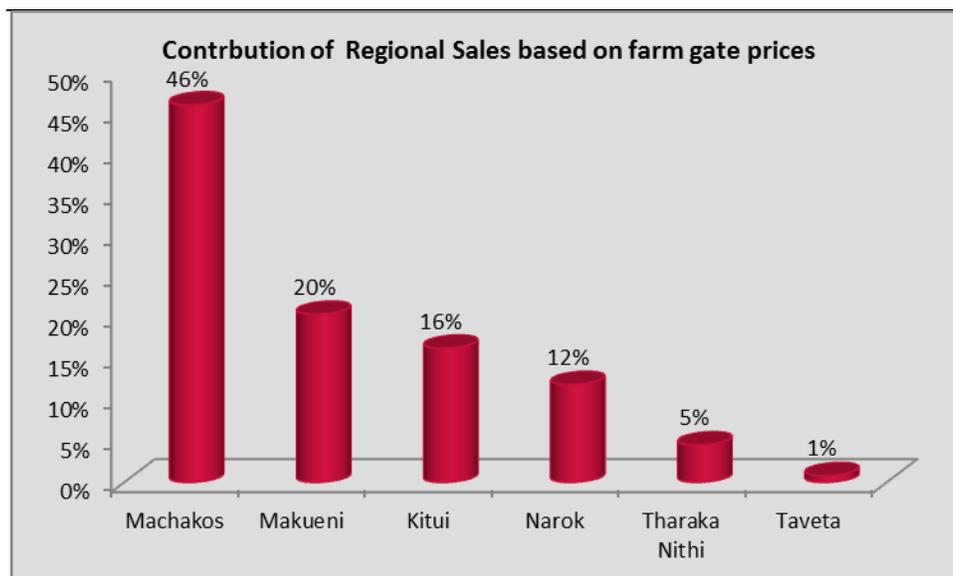
County	2010	2011	2012	2013	Total
Kitui	2	16	31	27	76
Machakos	56	336	423	168	983
Makueni	10	105	191	163	469
Taveta				8	8
Tharaka Nithi				11	11
Narok				4	4
Total	68	457	645	381	1,551

- Over the last four years, Machakos County has the highest number of producers/growers in pulses, followed by Makueni County. DLSC has expanded operation to new areas by contracting farmers in three new counties (Taita Taveta, Tharaka Nithi and Narok).

7. Overall County/Regional sales

County	Total (Ksh)	%
Machakos	14,080,459	46%
Makueni	6,263,046	20%
Kitui	4,997,428	16%
Narok	3,641,400	12%
Tharaka Nithi	1,385,400	5%
Taveta	238,272	1%
Total	30,606,005	100%

- Lower eastern (Ukambani) region contributed 82 percent of the total sales, with Machakos County ranking first with 46 percent, followed by Makueni 20 percent, and Kitui 3rd with 16 percent. The new production areas combined contributed 18 percent.



8. Portion of Land under Pulse Production

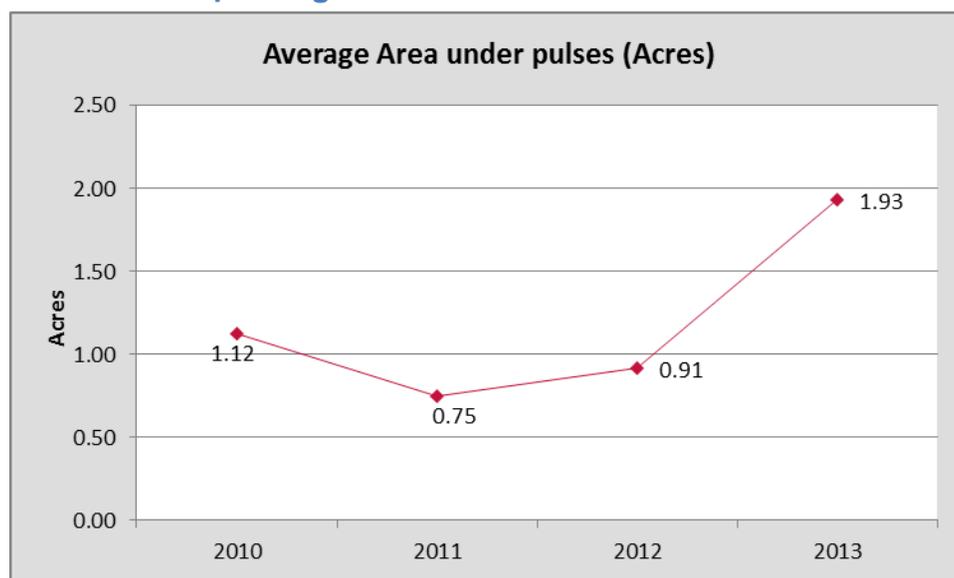
Area under pulse production (acres)				
County	2010	2011	2012	2013
Kitui	5	91	284	110
Machakos	55	642	804	271
Makueni	17	206	292	336
Taveta				22
Tharaka Nithi				46
Narok				139
Total	76	939	1,381	923

- Contribution to the Machakos County sales is due to diversity of pulse type being grown. This is attributed to more suitable climatic conditions, with higher rainfall for beans, cowpeas, and green grams.
- Competition with other products such as wheat and barley in Narok, and export peas in Taita Taveta, pushes the pulse production into marginal areas, like in Mwatate in Taveta County. This significantly reduces the area and yields.
- In Makueni, there is competition between pulses and horticulture farming. The cooler regions such as Mbooni, Kilungu and Kilome are conducive for horticulture such as snow peas, French beans and local vegetables, while mangoes are popular in hotter areas. The poor weather in Kathonzweni, Makindu, and Kibwezi aggravates the situation. This reduces the pulse diversity in the county.
- Cowpeas, beans and green grams are not frequently intercropped with maize, as compared with pigeon peas, which significantly reduce areas in Makueni and Kitui counties.

8.1 Average Area under Pulse Production

Average of Area under pulses (Acres)				
Pulse type	2010	2011	2012	2013
Bean	0.96	0.85	0.81	2.01
Cowpea	1.30	0.60	0.97	1.79
Green gram	1.42	0.87	1.14	2.13
Pigeon pea		0.64	0.47	
Total	1.12	0.75	0.91	1.93

8.2 Trend of Average Area under Production



- Overall, the area under pulse production increased by 72 percent, from an average of 1.12 acres to 1.93 acres per farmer.

8.3 Average Area under Production by County and Pulse Type

Average of Area under pulses					
	2010	2011	2012	2013	Grand Total
Kitui	2.50	1.78	4.38	4.07	3.38
Bean		0.36	0.43		0.37
Cowpea	2.50	1.09	3.78	4.07	3.29
Green gram		3.57	5.77		4.88
Machakos	0.98	0.69	0.67	1.18	0.74
Bean	0.92	0.86	0.82	1.33	0.91
Cowpea	1.00	0.57	0.54	0.83	0.59
Green gram	1.42	0.49	0.67		0.60
Pigeon pea		0.75	0.45		0.57
Makueni	1.68	0.77	1.15	1.70	1.16

Bean	1.28	0.92	0.39	1.51	1.25
Cowpea	1.95	0.61	1.51	1.57	1.24
Green gram		0.96	0.94	2.13	1.19
Pigeon pea		0.26	0.54		0.43
Taveta				2.72	2.72
Bean				2.72	2.72
Tharaka Nithi				4.20	4.20
Cowpea				4.20	4.20
Narok				34.67	34.67
Bean				34.67	34.67
Total	1.12	0.75	0.91	1.93	1.00

- Bigger acreage was noted in the new expanded areas, though with fewer farmers. This is because pulses are linked to large commercial farmers in this region, compared to smallholders in Ukambani region.

8.4 Total Area under Pulse Production

Total Area under Pulse Production (Acres)					
Variety	2010	2011	2012	2013	Total
Bean	34.5	371.2	410.1	456.8	1,272.6
Cowpea	37.7	260.0	499.9	357.3	1,154.8
Green gram	4.3	252.1	405.2	108.8	770.2
Pigeon pea		55.9	66.0		121.9
Total	76.4	939.2	1,381.2	922.8	3,319.6

- Beans occupy the largest acreage due to high gross margins; pigeon pea was least profitable, resulting in the least acreage and lowest adoption.

9. Annual Gross Income Distribution for Farmers

Farmers				
Income Distribution (Ksh)	2010	2011	2012	2013
0-10,000	88%	69%	38%	22%
10,001-20,000	6%	18%	28%	37%
20,001-30,000	6%	7%	15%	16%
30,001-40,000	0%	4%	9%	8%
40,001-50,000	0%	1%	4%	4%
Above 50,000	0%	2%	6%	14%
Total	100%	100%	100%	100%

- The percentage of farmers earning above Ksh 50,000 from pulse sales increased by 14 percent in 2013. Those earning below Ksh 10,000 reduced from 88 percent to only 22 percent and is attributed to the increased adoption of the new improved seed varieties.

10. Gross Margin Analysis

Beans

Activity/Item	Description	Cost	Total
Land preparation	First Ploughing	3,500	3,500
Seed	Certified seed	3,000	3,000
Fertilizer	DAP - 50Kg	4,400	4,400
	CAN - 50Kg	2,500	2,500
	Foliar feed - 2 kg	750	750
Pesticides	1 kg	850	850
Fungicides	1 kg	1,500	1,500
Planting	6 Man-days	200	1,200
Fertilizer application	5 man-days	200	1,000
Weeding	10 Man-days	200	2,000
Top dressing	5 man-days	200	1,000
Chemical application	5 man-days	200	1,000
Second weeding	10 Man-days	200	2,000
Chemical application	5 man-days	200	1,000
Harvesting	10 Man-days	200	2,000
Gunny bags	7	40	280
Threshing and winnowing	12 man-days	200	2,400
Preservative	1 kg	500	500
Production cost			30,880
Yield	700 kg	Unit Price 80	56,000
Net income per acre			25,120

Cowpea

Activity/Item	Description	Cost	Total
Land preparation	First Ploughing	3,500	3,500
Seed	Certified seed	1,000	1,000
Fertilizer	DAP - 50Kg	4,400	4,400
	Foliar feed - 2 kg	750	750
Pesticides	1 kg	850	850
Fungicides	1 kg	1,500	1,500
Planting	6 man-days	200	1,200
Fertilizer application	5 man-days	200	1,000
Weeding	10 man-days	200	2,000
Top dressing	5 man-days	200	1,000
Chemical application	5 man-days	200	1,000
Second weeding	10 man-days	200	2,000
Chemical application	5 man-days	200	1,000
Harvesting	10 man-days	200	2,000
Gunny bags	6	40	240
Threshing and winnowing	12 man-days	200	2,400
Preservative	0.5 kg	300	300
Production cost			26,140
Yield	600 kg	Unit Price 70	42,000
Net income per acre			15,860

Green gram

Activity/item	Description	Cost	Total
Land preparation	First Ploughing	3,500	3,500
Seed	Certified seed - 4 kg	220	880
Fertilizer	DAP - 50Kg	4,400	4,400
	Foliar feed - 2 kg	750	750
Pesticides	1 kg	850	850
Fungicides	1 kg	1,500	1,500
Planting	6 man-days	200	1,200
Fertilizer application	5 man-days	200	1,000
Weeding	10 man-days	200	2,000
Top dressing	5 man-days	200	1,000
Chemical application	5 man-days	200	1,000
Second weeding	10 man-days	200	2,000
Chemical application	5 man-days	200	1,000
Harvesting	15 man-days	200	3,000
Gunny bags	5	40	240
Threshing and winnowing	12 man-days	200	2,400
Preservative	0.5	300	300
Production cost			27,020
Yield	500 kg	Unit Price 90	45,000
Net income per acre			17,980

Pigeon pea

Activity/Item	Description	Cost	Total
Land preparation	First Ploughing	3,500	3,500
Seed	Certified seed -8 kg	220	1,760
Fertilizer	DAP - 50Kg	4,400	4,400
	Foliar feed - 2 kg	750	750
Pesticides	1 kg	850	850
Fungicides	1 kg	1,500	1,500
Planting	6 man-days	200	1,200
Fertilizer application	5 man-days	200	1,000
Weeding	10 man-days	200	2,000
Top dressing	5 man-days	200	1,000
Chemical application	5 man-days	200	1,000
Second weeding	10 man-days	200	2,000
Chemical application	5 man-days	200	1,000
Harvesting	5Mandays	200	1,000
Gunny bags	5	40	240
Threshing and winnowing	12 man-days	200	2,400
Preservative	0.5	300	300
Production cost			25,900
Yield	500 kg	Unit Price 80	40,000
Net income per acre			14,100

- All the pulses produced were profitable, with beans ranking first, followed by green gram, cowpeas, and pigeon peas.

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