

"APPLICATION OF SCIENCE AND TECHNOLOGY FOR INCREASED AGRICULTURAL PRODUCTION FOR ECONOMIC EMPOWERMENT AND SELF-SUFFICIENCY IN KADUNA STATE"

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The focus of this paper is to examine how science and technology can be employed in order to increase agricultural productivity in Kaduna State. An attempt was made to identify the factors militating against farmers achieving optimum output in their farming enterprises and how to overcome these factors. It also look at the utilization of the increase agricultural produce by industrial processors within and outside the State for economic empowerment and self sufficiency.

INTRODUCTION:

Nigeria is situated in the South of the Sub-Saharan Africa and occupies a total land area of 93 million hectares, which lies between longitude 3° and 14°E and latitudes 4° and 14° North. The ecological diversity of Nigeria ranges between the Southern mangrove and the Northern Sahel. As a consequence, there is considerable diversity in response to the ecological variability. The crop types grown in Nigeria include the tree crops (Oil palm, cocoa, coffee, rubber etc) legumes (Cowpea, soybean, pigeon pea etc), cereals (maize, sorghum, millet, rice, wheat etc), roots tubers (cassava, yams potatoes, etc) fruit crops (guava, pineapple, pawpaw, citrus, mango etc) vegetables (tomatoes, onions, pepper, amaranthus) fibre crops (cotton, kenaf and jute) (Alika, 1999). The array of crops produced in Nigeria is an indication that a large number of agricultural products can be derived through industrial processing of the crops for the benefit of the citizenry.

Formal agricultural research in Nigeria started as far back as 1893 when the first botanical research station was established by the colonial government (Gambo, 1996). Today we have 18 National Agricultural Research Institutes (NARI) in the various sub-sectors of Agricultural research, with over 900 core scientists employed by these institutes. These institutes are saddled with the responsibilities for researching into the development of new applied agricultural innovations of **new** technologies that will enhance the productivity of our peasant farmers.

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Kaduna State is like a mini Nigeria situated within the North-West agro-ecological zone of the country. It is located between latitudes $9^{\circ}.10'$ – $11^{\circ}.30'$ North and longitudes 6° – $9^{\circ}.10'$ East. It has a total land area of about 67,000 square kilometres. The total arable land in the state is estimated to be about 2,148,700 hectares. There are three main ecological zones; Southern Guinea Savanna, Northern Guinea Savanna and Sudan Savanna from the South to the Northern part of the state. With the variation in the ecological zones, such is the variation in crop types grown. The soil types also change from clay loam to sandy clay as one moves from the Southern Guinea to the Sudan Savanna ecologies. The rainfall pattern also changes from the South to the North. About 2000mm of rain is received annually in the Southern Guinea to about 600mm of rain in the Northern Guinea Savanna. With good rainfall within the growing season, most crops are grown across all the three ecological zones.

Out of the 18 Agricultural Research Institutes in Nigeria 4 are located within the State, in addition to Ahmadu Bello University, Zaria i.e.,

- Institute for Agricultural Research (IAR), Ahmadu Bello University, Zaria
- National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Zaria
- National Agricultural Extension Research and Liaison Services (NAERLS), Ahmadu Bello University, Zaria
- National Institute for Trypanosomiasis Research (NITR), Kaduna.

These research institutes generate new technologies that are applicable to the improved varieties of crops and livestock breeds that are developed by these institutes. This means that most farmers in Kaduna State have access to information on new technologies that they need to increase their crops and livestock yields. Unfortunately they are not using these new technologies, that is why the yields of the various crops and even animals are far below the research stations yields. Tables 1 compares the yields obtained using improved technologies for the various crops grown on the research fields as compared with on-farm yields.

Table 1: Data on crop performance at the on-station trials for various crops using the recommended management practices including improved seeds compared with on-farm.

Crop type	On-station (yields in t/ha)	On-farm (yields in t/ha)
Maize	4.0-5.0	2.5
Sorghum	2.5-3.5	1.86
Groundnut	2.5-3.0	1.6
Yams	50-60	10.2
Cowpea	2.5-3.0	0.77
Soyabeans	25-35	14.09
Garden egg	10-15	5.85
Rice	3-5	2.51
Millet	3-4	1.38
Okro	2.5-3.5	1.56
Ginger	2-3	0.55
Acha	2-2.5	9.33
Cassava	30-50	0.34
Mellon	2-3	1.61
Bambara groundnut	2-3	10.15
Sweet potato	25-30	6.87
Cocoyam	15-20	0.74
Pepper	10-15	6.0
Sugar cane	25-35	17.8
Irish potato	10-20	4.17
Peagion pea	5-10	2.08
Tomato	20-30	5.56
Cotton	2.5-3.5	0.65

Source: Aba (2005)

From the table, it is very clear that the farmers within the state are yet to obtain the optimum yields for all the crops grown. For maize, the on-station yields are double the on-farm yields, similarly with sorghum, the yields for the research stations are two to three times that of the farmers.

Groundnut which is a cash crop is not different, the yield in the research station is about three times that of the farmers. Cowpea yields on-station are three times that of the on-

farm. Similarly, for rice the yields for the research station are twice those of the farmers. Ginger is similarly high yielding at the on-station than on the farms.

Cassava gives a worse scenario, in this case about 30 – 50 times yield advantage is obtained in the research station over the performance at the farmers field. Cotton is not left out, in this case with two to three times yield advantage obtained at the on-station than at the farmers fields.

The reasons for this low yields at the farmers fields are not far-fetched. Most of our farmers do not use the improved/new technologies that are available for optimum yield advantage. This is clear from the following tables of a survey by the Kaduna State Agricultural Development Programme (KADP) of the main technologies that the farmers need to apply in order to obtained optimum yields of the crops.

TECHNOLOGIES AVAILABLE TO FARMERS IN KADUNA STATE

Many technologies that the farmers can apply to increase his yields abound, but we shall just look at the most important, i.e, improved varieties of seeds, inorganic fertilizer and agro-chemicals.

A. Improved Varieties of Seeds

Table 2: Use of improved seeds (% of plots): Wet seasons

S/No	Crop	2002	2004	% Diff.
1	Maize	44.36	53.64	20.92
2	Sorghum	16.98	22.75	33.98
3	Groundnut	16.67	24.35	46.07
4	Yams	0.00	11.54	0.00
5	Cowpea	16.67	20.00	19.90
6	Soyabeans	35.71	53.91	50.96
7	Garden eggs	0.00	50.00	0.00
8	Rice	20.83	27.65	0.00
9	Millet	25.00	30.00	20.00
10	Okro	14.29	20.00	0.00
11	Ginger	0.00	0.00	0.00
12	Acha	0.00	0.00	0.00
13	Cassava	25.00	30.00	20.00
14	Mellon	0.00	0.00	0.00
15	Bambara nut	0.00	0.00	0.00
16	Sweet potato	75.00	75.00	0.00
17	Cocoyam	0.00	0.00	0.00
18	Pepper	7.69	8.44	9.75
19	Onions	33.33	37.00	11.01
20	Sugar cane	0.00	0.00	0.00
21	Irish potato	0.00	0.00	0.00
22	Peageon pea	0.00	0.00	0.00
23	Tomato	30.00	40.00	33.33
24	Cotton	0.00	0.00	0.00

Source: KADP Report on State Survey 2004

This gives the percentage of fields that applied/used improved seeds for the various crops grown in Kaduna State for the 2002 and 2004 wet seasons

For maize, only 44% of the plots surveyed had used improved seeds, while in 2004, 53.6% of the plots used improved seeds. For Sorghum only 16.9% of the plots used improved seeds in 2002, while 22.75% of plots used improved sorghum seeds in 2004.

for Groundnuts, only 16.67% and 24.35% of the plots used improved seeds in 2002 and 2004 respectively. For cowpea 16.67% and 20% of the plots used improved seeds in 2002 and 2004 respectively. Soyabeans had 35.7% and 53.9% of the plots planted with improved seeds for the two years. For rice, 20.83% and 27.15% of the plots were planted with improved seeds for the two years. For millet, 25% and 30% plots were planted with improved seeds for the two years. Ginger which is a promising cash crop had no improved seed used in the two years. Surprisingly, sweet potato had 75% improved seeds used for the two years, even though it is not so much an important crop as the others.

Cassava that is being given attention as a cash crop, had only 25% and 30% of the plots planted with improved seeds. Cotton which has been a cash crop for many years had no improved seeds used for the two years. All other crops had small percentages or none at all of improved seeds use.

HOW DO WE OVERCOME THE PROBLEMS OF NON-AVAILABILITY OF IMPROVED SEED?

- The State Government should identify the crops where it has a comparative advantage and advance money to the research institutes that have the genetic mandate of such crops to produce enough foundation seeds for it e.g., for Foundation seeds of Maize, Sorghum, Cowpea, Groundnuts and Cotton varieties, the Institute for Agricultural Research (IAR), Ahmadu Bello University, Samaru-Zaria is in a position to handle such request.
- The Kaduna State Agricultural Development Programme (KADP) zonal offices should have seed farms. Each zonal office should identify a crop that it has the comparative advantage and produce the certified seeds of that crop which will be sold at a subsidized rate to the farmers. For example, Saminaka and Giwa are the most important maize growing areas in the State and in the country at large, therefore, Maigana and Lere zonal ADPs should buy maize Foundation seeds from IAR and produce their certified seeds which will be sold to the farmers at subsidized rate. This should apply to all other KADP zonal offices in the State.

B. Use of Inorganic Fertilizers

Table 3: Use of inorganic fertilizer (% of plot)

S/No	Crop	2003	2004	% Diff.
1	Maize	80.45	94.55	17.58
2	Sorghum	61.90	67.27	8.68
3	Groundnut	18.33	21.74	16.60
4	Yams	38.46	46.15	19.90
5	Cowpea	27.78	30.00	7.99
6	Soyabeans	29.51	43.48	47.33
7	Garden eggs	0.00	100.00	0.00
8	Rice	79.77	82.35	3.23
9	Millet	50.00	76.47	52.94
10	Okro	57.14	77.78	36.12
11	Ginger	51.67	88.83	71.91
12	Acha	71.43	71.78	0.49
13	Cassava	12.50	0.00	0.00
14	Mellon	0.00	100.00	0.00
15	Bambara nut	0.00	0.00	0.00
16	Sweet potato	0.00	0.00	0.00
17	Cocoyam	37.50	40.00	6.67
18	Pepper	76.92	77.78	1.12
19	Onions	0.00	0.00	0.00
20	Sugar cane	0.00	0.00	0.00
21	Irish potato	0.00	0.00	0.00
22	Peageon pea	0.00	0.00	0.00
23	Tomato	0.00	0.00	0.00
24	Cotton	0.00	0.00	0.00

Source: KADP Report on State Survey 2004

Table 3 shows percentages of the use of Inorganic fertilizers in the plots of crops surveyed. The use of fertilizers has gained a lot of grounds in the state especially as regards to maize production. This may be attributable to clear yield gains that are obtained in the crop when fertilizers are used. Sasakawa Global 2000 will also share in this glory for its practical participation in the promotion of the use of fertilizers by farmers in Kaduna State. As a result, maize had 80.45% and 94.55% of the plots surveyed

applied inorganic fertilizers for the 2002 and 2004 wet season. Even sorghum was also given attention, with 61.9% and 67.27% of the plots had fertilizer applied which is quite encouraging. This may be attributable to some sorghum seed production projects that usually supply some fertilizers to the farmers involved with such projects in the state (Aba *et al.*, 2003). The use of fertilizers is still very low on Groundnuts which is a cash crop, only 18.33% and 21.74% of the plots surveyed had fertilizers applied in the 2002 and 2004 wet seasons respectively. Yam is gradually gaining some attention because it is also a cash crop in the state with 38.46% and 46.15% of the plots having fertilizers applied for the two years respectively. Cowpea had only 27.78% and 30% fertilizer application for the two years. Rice which is also a cash crop is also given attention in the last two years. About 79.77% and 82.35% of the plots were given fertilizers. Millet also had 50% and 76.47% of the plots with fertilizers. Ginger which is also a cash crop also received some good amount of fertilizers, 51.67% and 88.83% respectively. Cassava which is currently the presidential initiative crop as a cash crop had only 12% and zero percentage fertilizers in the two years. Other crops that had some good fertilizer application include pepper (76.9% and 77.78%) for 2002 and 2004 and Coco yam also with 37.5% and 40% respectively. Again, Cotton which is one of the leading cash crops in the State and in Nigeria had no fertilizer applied to all the plots surveyed in the two years. This shows that we can never get the optimum yields unless the technology of the use of inorganic fertilizers is properly and inadequately applied.

The problems of fertilizers procurement and distribution currently being handled appropriately by the Kaduna State Government this include

- Timely procurement before the rainy seasons
- Subsidizing the cost of the fertilizers
- Access to micro-credit by the farmers.
- Access road network to the rural areas for evacuation of farm produce.

C. Use of Agro-chemicals

Table 4: Use of Agro-chemicals (% of plots): Wet seasons

S/No	Crop	2003	2004	% Diff.
1	Maize	6.77	14.55	114.91
2	Sorghum	8.49	1.83	-78.44
3	Groundnut	0.00	4.35	0.00
4	Yams	0.00	19.23	0.00
5	Cowpea	16.67	25.00	49.97
6	Soyabeans	2.38	2.17	-8.82
7	Garden eggs	0.00	50.00	0.00
8	Rice	20.83	52.94	154.00
9	Millet	0.00	0.00	0.00
10	Okro	0.00	0.00	0.00
11	Ginger	0.00	66.67	0.00
12	Acha	0.00	0.00	0.00
13	Cassava	0.00	0.00	0.00
14	Mellon	0.00	0.00	0.00
15	Bambara nut	0.00	0.00	0.00
16	Sweet potato	0.00	0.00	0.00
17	Cocoyam	0.00	0.00	0.00
18	Pepper	0.00	11.11	0.00
19	Onions	0.20	0.00	0.00
20	Sugar cane	0.25	0.00	0.00
21	Irish potato	0.00	0.00	0.00
22	Peageon pea	0.00	0.00	0.00
23	Tomato	0.00	0.00	0.00
24	Cotton	0.00	0.00	0.00

Source: KADP State Survey 2004

Agro-chemicals include herbicides, pesticides, fungicides, bactericides etc for the control of weeds and pests and other diseases in the crops for optimum yields.

Table 4 gives the percentages of the plots in which agro-chemicals were used in the 2003 and 2004 wet seasons.

For maize, 6.77% and 14.55% of the plots were cared for by the use of agro-chemicals during the two years respectively. For Sorghum 8.49% and 1.83% of the plots were treated with agro-chemicals in the two years. Groundnut had virtually nothing applied to the crop in the two years. Rice had a better attention with 20.83% and 52.94% of the plots surveyed treated with chemicals which consist of herbicides mostly for weed control.

For Ginger, Cassava, Cotton no chemicals were applied. Even tomatoes were not treated for any pests and disease. This indicates that our farmers still don't see the implications of not controlling pests and diseases in their crops. We know that some diseases e.g. stem borers can cause about 75% crop failure in maize and sorghum.(Obilana *et al.*, 1984).

The Institute for Agricultural Research is researching on the use of local products/botanicals (Neem tree products) for the control of pests and diseases. I hope recommendations would be out soon so that our farmers will source for natural products for use. Similarly, *Striga* which causes yield losses of upto 100% in cereals (Gupta and Lagoke, 1999) is being tackled by a group of scientists in IAR, using what is called mycoherbicide (Marley *et al.*, 2003) to control. This technology is showing some great promise, and soon, recommendations will be out for its use.

HOW DO WE OVERCOME THIS PROBLEM?

1. More demonstration plots need to be put out at the farm level for the farmers to practically see what needs to be done in case there is a problem of pest or diseases. What chemicals to use to control which pests or diseases.
2. KADP zonal offices need to organize trainings for farmers in order to educate them on the use of these agro-chemical – MTRN's/QTRMs.
3. Research Institutes could be called upon by the State Government to conduct trainings for ADP Staff who will then train the farmers.

INDUSTRIAL UTILIZATION AND COMMERCIALIZATION

On the supply side, agriculture in Kaduna State has experienced growth in the production of primary cereal and tuber crops. However the growth in yield has been either very low or negative. In fact, in most cases farmers yields have by far fallen short

of research yield. This means increase in production is coming from increases in land area sown to crops and not from yield increases.

Our investigation revealed that Kaduna State farmers have not embraced enough science based agriculture and the use of fertilizer, improved seeds and crop protection chemicals. Land expansion is limited and without science-based agricultural inputs, agricultural production will decline. The government requires policies that encourage an agricultural sector that has high investment growth rate. The key element of this strategy is an efficient and well functioning agricultural input market making use of the complementary among fertilizer, improved seeds and crop protection products.

To introduce new technologies involving higher input costs, it is necessary to ensure that farmers make money. They must be able to sell their products at competitive prices. There is therefore need to complement productivity – enhancing technology and well-functioning output market. A good functioning agricultural output market embodies improved storage and agro-processing technologies, that will reduce wastes, add value, and increase demand for farm outputs. This market-driven-technology approach will increase agricultural productivity and enhance commercialization opportunities for agricultural products to ensure food security, raise farmers income and contribute to the development of effective agro-industrial sector.

Having identified the problems militating against the production of optimum yields in the crops produced in the State and how to overcome such problems, it is important to also identify the uses of these crops in industries so that our farmers are aware of the great potentials of these crops as sources of generating revenue in order to improve their income thus alleviating poverty in the state and in Nigeria at large.

Table 5: Main crops produced in the 23 Local Government Areas of Kaduna State and their industrial uses

No	Local Government Area	Major crops	Industrial use
1	Giwa	Maize, sorghum, groundnut, rice, cotton, soybean, cowpea, millet, tomato, onion, yam, garden egg	Flour, oil, bran, starch, syrup, grits, alcohol, meal, malt, etc -Canned – concentrated milk pepper – Flavours – Cakes
2	Sabon Gari	Maize, sorghum, rice, groundnut, cowpea, cotton, yam, tomatoes, onion, garden egg, pepper, sugarcane	Flour, oil, bran, starch, syrup, grits, alcohol, meal, malt, etc -Canned, - Sugarcane sugars
3	Zaria	Maize, sorghum, sugarcane, rice, groundnut, yam, cotton, cowpea, millet, tomatoes, onion, pepper	Flour, oil, bran, starch, syrup, grits, alcohol, meal, malt, etc -canned – sugarcane sugars – chips
4	Soba	Sorghum, maize, groundnut, cowpea, yam, rice, cotton, millet, tomatoes, mangoes, onions, pepper, sugarcane	Flour, oil, bran, starch, syrup, grits, alcohol, meal, malt, etc -Canned -Sugarcane, sugars
5	Ikara	Sorghum, maize, millet, cotton, cowpea, rice, tomatoes, onions, garlic, pepper	Flour, oil, bran, starch, syrup, grits, alcohol, wheat, malt, etc – Canned – flour – medicinal
6	Makarfi	Sorghum, maize, millet, rice, cowpea, cotton, sugarcane, tomatoes, onions, pepper	Flour, oil, bran, starch, grit, syrup, alcohol, malt, meal, etc – Sugar cane sugars -canned – flavour
7	Kauru	Sorghum, maize, cowpea, rice, cowpea, sugarcane, tomatoes, onions, pepper, irish potato	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc flakes – canned – flavour, sugarcane sugars
8	Lere	Maize, sorghum, soybean, cowpea, rice, yam, groundnut, sugarcane, tomatoes, onions, pepper, irish potatoes	Flour, oil, bran, starch, syrup, grits, alcohol, meal, malt, etc -canned – flavours siugarcane sugars
9	Birnin Gwari	Maize, sorghum, rice, millet, tomatoes, onions, pepper	Flour, oil, bran, starch, grit, syrup, alcohol, meal, malt, etc – canned – flavours

No	Local Government Area	Major crops	Industrial use
10	Kubau	Maize, sorghum, rice, cowpea, groundnut, soybean, tomatoes, onions, pepper	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, -canned - flavour
11	Kachia	Maize, sorghum, rice, cowpea, soybean, yam, tomatoes, onions, pepper, ginger, honey	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc -canned - flavour - medicinal - candle
12	Chukun	Maize, sorghum, rice, cowpea, groundnut, soybean, tomatoes, onions, pepper, honey	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt etc - canned - flavours - medicinal - aromatic
13	Igabi	Maize, sorghum, rice, cowpea, pepper, cowpea, honey, tomatoes, onions, pepper	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, -Canned, -Flavour, - Medicinal, - Aromatic
14	Kaduna North	Maize, sorghum, rice, soybean, cowpea, tomatoes, onions, pepper, mango, citrus	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc - Canned, - flavour, -Juices
15	Kaduna South	Maize, sorghum, rice, soybean, cowpea, mango, citrus, tomatoes, onion, pepper	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc -Canned, -flavour, - juices
16	Kajuru	Maize, sorghum, rice, soybean, cowpea, groundnut, honey, tomatoes, onions	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc - Canned, - -Medicinal, - Aromatic.
17	Kudan	Maize, sorghum, millet, rice, groundnut, cowpea, tomatoes, onions, pepper	Flour, oil, bran, meal, starch, syrup, grits, alcohol, malt, etc -Canned, -Flavour
18	Kagarko	Maize, sorghum, rice, ginger, mango, citrus, honey, tomatoes, onion, pepper	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc -Juices, - canned, Aromatic/medicinal
19	Kaura	Maize, sorghum, rice, millet, yam, cassava, groundnut, mango, citrus, honey, tomatoes, onion	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc pellets, chips. -Juices, - Medicinal, canned, - aromatic

No	Local Government Area	Major crops	Industrial use
20	Jema'a	Maize, yam, sorghum, rice, acha, cassava, ginger, mango, citrus, honey, soybean	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc pellets, chips. – Juices, aromatic, - flavour, - medicinal
21	Zango Kataf	Yam, sorghum, maize, rice, soybean, groundnut, ginger, mango, citrus: Honey, Tomatoes, onions	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc –Juice, -canned, -medicinal, -aromatic
22	Jabba	Ginger, sorghum, maize, rice, acha, yam, palm tree, honey, mango, citrus	Flour, oil, bran, starch, grits, syrup, alcohol, meal, malt, etc –palm oil, -juices, -medicinal, - aromatic
23	Sanga	Yam, cassava, maize, sorghum, rice, acha, ginger, soybean, palm tree, cotton, banana, honey, mango, citrus	Flour, brand, oil, starch, grits, syrup, alcohol, meal, malt, etc –pellets, chips, - juices, palm oil, medicinal, -aromatic, -cakes, -cotton seed oil

Source: Aba (2005)

Table 5 gives the major crops produced in each of the 23 local Government areas of the state and their use in industry.

- ❖ Giwa Local Government grow mostly cereals, legumes and vegetable crops. The cereal crops are used in industries for making flour, bran, starch, syrup, alcohol, meal and malt. The legumes could be used for oil, concentrated milk and cakes, while the vegetables could be canned and for the production of flavours. Cotton for textiles, feeds and oil.
- ❖ Sabon Gari Local government is also a home of cereals, legumes and vegetables. Similarly, the cereals are utilized in the flour mills, bran, starch, syrup, grits, alcohol, meal and malt etc. other industrial processing include canning of vegetable and production of sugarcane, sugars and pepper for flavours, cotton for textile feeds and oils.
- ❖ Zaria Local Government also produced cereals used in the production of flour, meal, alcohol, syrup, grits, starch, malt and meal. Other industrial uses include sugar from sugarcane conning of vegetables crops and chips. Cotton for textiles feed and oils.

- ❖ Soba Local Government Area is notable for the production of cereals, legumes vegetables and sugarcane. Industrial uses include the production of flour, bran, starch, syrup, grits alcohol, meal and malt. Others include canning of vegetables, extraction of sugarcane sugars and making of flavours. Cotton for textiles, feed and oils.
- ❖ Ikara Local Government: they are notable for cereals, legumes vegetables which can be used in industry for the production of flour, oils, bran, starch, meal, grits, alcohol, meal and malt etc. Others include canning of vegetables, extraction of industrial sugars and making of flavours. Cotton for textiles, feeds and oils.
- ❖ Makarfi Local Government they are also involved in the production of mostly cereal crops, legumes, vegetable and sugarcane. Industrial uses include, flour making, starch, syrup, grits, bran, alcohol, meal and malt. Other processing include vegetable canning, sugarcane for sugar. Cotton for textiles, feeds and oils.
- ❖ Kauru Local Government Area is notable for the production of cereals, legumes, sugarcane, vegetables and pepper. Industrial processing includes the production of flour, meal, starch, syrup, grits, alcohol, malt, bran etc. other sugars from sugarcane and legumes for oil cakes and concentrated milk.
- ❖ Lere Local Government Area is notable for cereals, mostly maize and sorghum and little millet which can be processed into flour, meal, starch, grits, alcohol, malt; while legumes will be processed for oil, concentrated milk.
- ❖ Birnin Gwari Local Government Area has majorly cereal followed by legumes and fruits. The industrial uses will be similar to the other areas mentioned are for meal, grits, alcohol, malt and bran, sugars from sugar cane.
- ❖ Igabi – mostly cereals, some legumes, vegetables and fruits. Added value include flours, grits, bran, starch, alcohol, malt, meal while others will be for canning, flavour, medicinal, candle etc.
- ❖ Kaduna North – this is also a cereal growing zone, other crops are vegetables and fruits. For processing, it will include flour, meal, bran, grits, starch, alcohol, malt, while canning of vegetables is another industrial use, flavours and making of juices.
- ❖ Kaduna South – this is similar to Kaduna North in most of its crops produce and also for the industrial processing.
- ❖ Kajuru – this local government is also a cereal producing zone, with legumes, vegetable and honey. This means that malt, syrup, grits, alcohol can be produce while the legumes will be use for canning. Others for flavours..

- ❖ Kubau produces cereals mostly, the legumes, vegetables and fruits. For processing it will be for flour, bran, starch, grits, alcohol, meal and malt while the legumes will be used for oils, concentrated milk and cakes. Fruits will be used to produce juices.
- ❖ Kachia produces cereals, tubers, legumes, fruits and vegetables. The industrial processing will include the production of flour, grits, starch, syrup, alcohol, meal and malt; while vegetables will be canned, and juices will be extracted from fruits, flavours and essential oils for export from ginger.
- ❖ Chukun – mostly cereals are grown, then legumes, ginger fruits and vegetables. The industrial processing will include flour, bran, malt, grits, meal, starch, alcohol; for legumes, it will be for oil, cakes, concentrated milk etc. vegetables will be canned and medicinal products and candle from honey products.
- ❖ Kudan – this is a cereal producing area, with vegetables, legumes and sugarcane. The industrial uses will be for flour, starch, grits, bran, alcohol, meal, malt; while for legumes there will be cakes, concentrated milk and flavours.
- ❖ Kagarko – this local government is also good in cereals, legumes, honey and tubers: this mean that the most important industrial use is for flour, meal malt, alcohol, grits; legumes will be for oils, concentrated milk, cakes; tuber will be processed into grits, starch, pellets while the honey will be processed into medicinal products candle and aromatic products; fruits into juices.
- ❖ Kaura - here also, cereals are prominent, tubers, fruits and vegetables. The most popular industrial uses will include, flour, meal, malt, starch, alcohol, grits, tubers – grits, chips, pellet; for the fruits – juices is very important and legumes will be processed into cakes, concentrated milk etc.
- ❖ Jema'a – this local government area is most popular with tubers, cereals, fruits vegetable and honey. For industrial processing it will produce flour, starch, alcohol, malt, meal, bran; for tubers – pellets, chips, flakes, fries; for fruits, juices will be produced, while for vegetables they will be canned. For honey, aromatic and medicinal products can be produce.
- ❖ Jabba – the most popular crop is Ginger, then cereals, honey and palm tress. Industrial uses include processed ginger and the oil for local and export consumption; flour, meal malt, alcohol, bran from cereals; and canning for vegetable, while juices will be produce from fruits.
- ❖ Sanga – this local government is known for its tubers, fruits, palm trees and cereals. Their uses in industry will include flour, flakes, meal, chips, pellets, starch, fries etc.

for fruits, juices will be processed from them while palm oil, palm kernel; for honey, it will be for aromatics, medicinal products, Ginger will be for flavours, oil etc.

- ❖ Zango Kataf - this local government is also known for cereals, tubers, ginger and honey – processed products will include, flour, starch, grits, alcohol, meal and malt; for tubers pellets, chips, starch, flakes, fries. For honey, medicinal, aromatic, candle, etc.

A number of industries and processors which require these crops as raw materials in large quantities already exist in the state and are shown in the table below.

Industrial Processors in Kaduna and Kano States of Nigeria.

Maize			Sorghum			Millet		
Maize processor	State	Industry	Sorghum processor	State	Industry	Millet processor	State	Industry
Feed Master Ltd	Kaduna	Livestock feed	Star feed	Kaduna	Livestock feed	Guinea feeds	Kaduna	Livestock feed
Sanders Ltd	Kaduna	Livestock feed	IBBI Ltd	Kaduna	Beverage	Prime feed	Kaduna	Livestock feed
Feedex Ltd	Kaduna	Livestock feed	Cardbury Plc	Kaduna	Food and confectionary	Nestle Plc	Kaduna	Food and confectionary
Ideal flour Mills Ltd	Kaduna	Food and confectionary	Guinness Plc	Kaduna	Beverage	Animal care	Kano	Livestock feed
PLS	Kaduna	Livestock	Nigerian Brewery	Kaduna	Beverage	-		
Dangote flour mills	Kano	Food and confectionary	-	-	-	-		
Northern Nigeria Flour Mill	Kano	Food and confectionary	-	-	-	-		

CONCLUSION

Agriculture is and will remain an important and vital sector of the economy in Nigeria. Kaduna State is an important member with very high potential and resources to be called upon to supply more food to the growing and more prosperous population and to be a foreign earner.

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