Scholarly Journals of Biotechnology Vol. 2(1), pp. 7-10, January 2013
Available online at http:// www.scholarly-journals.com/SJB
ISSN 2315-6171 © 2013 Scholarly-Journals

Full Length Research Paper

Physics: A panagea for food insecurity in Nigeria

[1]David T. W.* and [2]Otunaiya A. O.

[1]Department of Physics. [2]Department of Agribusiness and Farm Management Olabisi Onabanjo University, Ago-Iwoye.

Accepted 2 October, 2012

The problem of geometrical increase in population growth compare with the production and supply of food, poses a problem of food insecurity in the nearest future. This paper examines the applications of physics in rescuing the situation by ensuring improvement on production and proper handling of storage, distribution, as well as packaging and marketing of the goods. The knowledge of physics has brought innovations to Agriculture in areas such as the application of indicated power (ip), brake power(bp), friction power (fp), mechanical efficiency, brake mean pressure (bmep), engine power, rated take-off power, hydraulic power, drawbar power and draft, which help to invent and increase the efficiency of farm machinery like tractors, bulldozer, harvesters, etc. The paper, therefore, concludes that the application of physics in Agriculture would increase the number of land hectarage that would be put into cultivation and ensure availability of farm produce throughout the year through enhanced preservation and storage technologies which would invariably increase food production in Nigeria.

Keyword: geometrical increase, food insecurity, friction power

INTRODUCTION

Learner dictionary defines food as something that living creatures or plants take into their bodies to develop, while insecurity is a lack of protection against danger or risk. Literally, therefore, food insecurity is a lack of protection against food crisis or shortage to preserve life. The insecurity in food supply in Nigeria today is as a result of negligence of physics and its applications in Agriculture.

Fear of food insecurity all over the world arises because of Malthus theory, that, there is possibility that population might outstrip food supplies. Less than a decade ago the shortfalls in food production in several areas of the world raised the prospect of a world food crisis (Lawrence & Lacy, 1991).

Food security strategies have multiple dimensions that range from ensuring the food supply at national, state and local levels, to ensuring sufficient effective demand for adequate food consumption. The ultimate goal of an effective food security strategy is to provide for individuals adequate dietary intake through availability and accessibility of food, which are necessary conditions for nutritional well-being (Mbanasor, Jude A, 1999). Unavailability and inaccessibility to food are two essential determinants of food insecurity. The first does not ensure the second. For instance, food may be available, but a household for various reasons may not have access to the food.

In theory, two types of food insecurity abound, namely, chronic and transitory; but in reality they are closely related. Chronic food insecurity is a persistently inadequate diet caused by the continual inability of people to acquire needed food, either through market purchases or through production. Transitory food insecurity, on the other hand, is a temporary decline in peoples access to the required food, due to factors such as instability in food, in food prices, production or incomes (World Bank, 1988). Food insecurity refers to deficits or shortfalls of actual per capital daily calorie intake below the trend. The minimum per capita daily calorie intake recommended by FAO AND WHO for maintaining the human body is 24.50k cal day (Rosen & Shapour, 1994; Riscopoulos et al, 2000).

The primary determinant of food insecurity is domestic food production shortfalls, declines in export earnings, sudden rises in food prices, and inadequate food assistance (Rosen & Shapour, 1994). banasor (1999) showed that about 87% of Nigerian food problems would be solved by promoting domestic food production. This is achievable through the application of physics theories to

*Corresponding Author Email: wemidavid@yahoo.com

the development of improved farm machines.

Nigeria's food insecurity problem can be solved in the short and long runs through adequate use of physics as a strategy to food production. The role of physicist and the knowledge of physics in food production in Nigeria needed to be identified. This paper attempted this through the assessment of areas of involvement of physics in enhancing the food security.

Food Situation in Nigeria

Prior to Nigeria's independence, food shortages were hardly an issue of concern to many households. The percentage of food to total imports into the country was lower before 1967 than in the 1970s and beyond. For instance, food imports constituted 10.1 percent of total imports in 1966 as against 12.6 percent in 1978 and 17.0 percent in 1985 (Central Bank of Nigeria, 1989).

Indications of food problems in Nigeria started to emerge as from the first decade of the country's independence (1960-69) (Federal Republic of Nigeria, 1988). These indications were clearly evident from increasing food prices. At the time, the problems were thought to be the temporary effects of a series of crises which eventually culminated in the civil war (1967 – 1970). Therefore, not much national concern was shown. However, the second decade of Nigeria's independence (1970 – 79) witnessed a rapid deterioration in the country's food situation. Not only were there widening food supply-demand gaps there were also rising food import bills (Falusi, 1990).

Agricultural Export (quantity and value) fell drastically and import of basic food items grew at an alarming rate. Food import bill rose from N70 million in 1970, N88.3 million in 1971 to well over N2 billion in 1981 (Olayide, 1982; Rhoji, 1996). Inspite of the ban on the importation of some agricultural commodities such as rice, maize and wheat in 1986, the value of food imports in 1987 was N1,873.9 million.

This indicated an increase of 13.6 percent over the 1986 value (Central Bank of Nigeria, 1988) The food import bills were N3, 763.5 million in 1990 and N7, 785.5 million in 1991. The value increased to N11,738.4 million in 1992, N13,912.9 million in 1993 and N16,589.8 million in 1994 (Central Bank of Nigeria, 1994). It rose to N103, 489.8 million in 1999 and N1113, 630.5 million in 2001. This implies that food production is decreasing yearly in Nigeria (Central Bank of Nigeria, 2001).

Development in the Physics of Food Production

The application of physics in Agriculture is not limited to animal production alone. It also applies to crop production. Generally, mechanization, a strategy for abundant food supply, is not possible without the application of physics. It is the link between engineering and agriculture. Farm mechanization is the application of physics and engineering techniques in agricultural production, storage and processing of plant and animal products in the farm.

The typical Nigerian farmer has remained peasant in nature, operating with simple traditional tools of cutlass, hoe, axe, etc. and planting varieties of crops and rearing local breeds of livestock. The use of local simple tools is however very laborious. This, therefore, limits the size of farm that can be cultivated by an individual to an average of about 2 hectares. Hence, to increase the hectarage of cultivation would require the use of machines with large horsepower.

Farm machines are enhanced by physics theories to save time, work faster, increase yield, reduce farm drudgery, produce uniform and high quality farm produce and increase hectarage under cultivation. Example of common farm machines, designed with physics principles, whose tremendous contributions to production level in Agriculture cannot be over-emphasized include: Incubator, Bulldozer, Milking machine, Candler, Grains Shelters, drier and tractor which is about the most important machine, in land cultivation for agricultural purposes. The tractor supplies the power used to operate other farm implements like the plough, harrow, planter, harvester and so on.

Mechanical power supply by these machines superseded human or animal power. A major benefit has been to enable farm operation to be carried out optimally. However, the availability of mechanical power on farm depends on the development of physics and its relevant to the problems of agriculture.

The efficiency of farm machines have been enhanced through the following physics applications:

Indicated Power: The indicated power of an engine is the power actually developed in the cylinders. It can be determined from the expression:

ip = PLAN (watts)

where;

P	=	indicated mean effective pressure (N/m^2)
A	=	area of piston (m)
L	=	length of stroke (m)
N	=	number of working strokes/s

For a four-stroke engine, N/2 = rev/s. Since there is one working stroke in each revolution.

Brake Power (bp) = this is the useful work output of an engine which can be determined from the equation:

bp = 211 NT(watts)
where: T = Torque in Nm
N = number of working stroke/S

The brake power is less than the indicated power since, from cylinders to shaft there are losses which occur, such as friction.

Friction Power (fp): This is the power lost to friction as a result of various reciprocating and rotating parts of the engine. It can be determined from the equation fp = ip – bp.

Mechanical Efficiency: The mechanical efficiency of an engine is defined as the ratio of the bp to the ip.

Brake Mean Pressure (bmep): This is obtained from the relationship:

bmep = imep x mech = Pm x mechanical

Engine Power: This is the power measured at the flywheel or crankshaft.

Rated Speed: This is the engine speed specified by the manufacturer for continuous operation at a full load.

Manifold Depression: This is the pressure measured in the inlet manifold of a spark ignition engine at a point downstream of the carburetor.

Brake: This is a means of applying a controllable load to the output shaft of the engine.

Power take-off Power: This is the power measurement at any shaft designed by the manufacturer to be used as power take-off.

Hydraulic Power: This is the power available from the tractor's hydraulic system, at a convenient tapping supplied by the manufacturer, to drive external motors or cylinders.

Drawbar Power: It is the power available at the drawbar sustainable over a distance of at least 20 metres.

Draft: This is the force exerted on the tractor to drawbar by a load being towed by the tractor (Osunlaja, et al., 1997).

Advancement in application of physics has produced farm machine that could be set up to do many farm operations, at the same time, such as to: disintegrate crop residue; break up consolidated layers of soil with subsoiling times; set up ridges; and apply fertilizer in bands. With a different set of working heads the machine would later Earth-up the ridges, cultivate the upper surface of the ridge to provide a seedbed; incorporate a pesticide in the seed zone; place additional fertilizer in the sides of the ridge; and plant and cover the seed.

Another area of interest for food production is atmospheric physics. The proper knowledge of the weather conditions at a location is of utmost importance for optimal production. For example, rainfall depends on the physical parameters of temperature, pressure, and wind speed. Knowledge of these parameters and their evolution in time can lead to better planning for planting. This can reduce the incidence of crop failure due to drought.

Applying Physics in animal production, heat and moisture production data has been used for design of the structure, including ventilation system of livestock houses. Environmental modifications have been developed for cooling and heating livestock structures and these systems, for economic feasibility in livestock production.

Animal wastes have not always been fully utilized. The anaerobic digester was designed to thermo chemically convert animal waste to produce a low-energy gas for fuel r synthesis gas (biogas) (Guest, R. W. et al 1983). This is useful in gas-fired boilers, water heaters and furnaces in Agro processing.

In livestock management, animal and identification has been made easy with Transponders which serve as a link between the animal carrying an identification code and a receiving system (Bridle, J. E, 1976). The enhances record keeping of animal's performance. Also detection of oestrus in animals is made easy with an electrical conductivity in electrical has been developed to detect changes in electrical conductivity and volume of vaginal mucus which has reduced the rate of animals failure to conceive (Marshall, R., 1979).

Electronic instrumentation is available for measuring milk yield by volume or by weight is available for measuring milk yield by volume or by weigh (Mundy, E. J, 1980). This has tremendously reduced the risk involved in dairy farming. Also a walk through weigher for dairy cows has been developed (Filby, D. E., 1979). An electronic circuit involving a continuous averaging technique and peak hold capabilities is used to obtain each cow's weight from a suitably modified and commercially available weight crate.

With the addition of automatic animal identification and data processing capability to a microcomputer, live weights trends can be established automatically with reasonable accuracy. Such information can be used as an indication of health status and nutritional requirements.

Most of these machines are rarely found in Nigeria. Nigerian farmers are subsistent the few commercial farms lack modern machinery; the existing machines could not be maintained for lack of parts to replace the worn out ones. These are as a result of negligence of physics in farm production.

Since importation of farm machines is out of the reach of an average Nigerian farmer, and the government is not making such modern machines available, it is, therefore, imperative for our society to look inwards by exploring physics knowledge in redesigning and improving the locally made farm machines.

Policy Implication and Conclusion

It can be implied from the findings that physics whose serious positive impact on commercial farming is enormous was yet to be recognized as a solution to mechanization of small scale food production in Nigeria. Hence, unless the various problems limiting the development of physics in Agriculture are adequately attended to, the problem of food insecurity will remain. It is, therefore, recommended that:

- Physicist should be involved in policy making with respect to food production strategies.
- The center for agricultural mechanization should be more involved in the activities of equipment manufacturers and encourage the services of Physicist so that appropriate farm machinery can be produced locally.
- Agricultural physics should be taught in physics department of higher institutions to stimulate young physicist to their role in Agriculture.
- Interdisciplinary research on improvement of farm machinery should be encouraged in departments of physics, agricultural engineering and agriculture in Universities.

REFERENCES

Bridle, JE (1976). Automatic dairy cow identification. J. Agric. Engine. Res. 21(1): 41 – 48.

Central Bank of Nigeria (CBN) (1988). Annual Report and Statement of Accounts, Lagos Nigeria.

Central Bank of Nigeria (CBN) (1994). Annual Report and Statement of Accounts, Lagos Nigeria.

Central Bank of Nigeria (CBN) (2001). Annual Report and Statement of Accounts, Lagos Nigeria.

Falusi, AO (1990). Promoting Small Holder Agricultural Development in Nigeria: The ADP Experience. A Valendictory Lecture, University of Ibadan.

Federal Republic of Nigeria (1988). Agricultural Policy of Nigeria.

Filby, DE, Turner, MJB, Street, MJ (1979). 'A walk-through weigher for diary cows', J. Agric. Engine. Res. 24(1): 67 78.

Guest, RW, Koelsch, RK, Walker, HP (1983). On-farm biogas system: Issues facing the dairyman. 2nd National Dairy Housing Conference Proceeding. Wisconsin. ASAE Pub. 4: 92 – 99.

Lawrence, B, William, BL (1991). Food Security in the United State, Oxford University Press.

Marshall, R, Scott, NR, Barta, M, Foote, RH (1979). Electrical Condutivity Probes for detection of oestrus in cattle. ASAE, 22(5): 1145 – 1151.

Mbanasor, JA (1998). 'Strategies for enhancing rural household food security in Nigeria'. Poverty Alleviation and Food Security in Nigeria, in Y.L. Fabiyi and E. O. Idowu (eds). pp. 28 – 32.

Mundy, EJ (1980). Electronics and the bridgets dairy herd. J. Agric. Engine. 35(2): 38 – 39.

Olayide SO (1982). 'Agricultural Policy for Nigerian Small Farmers' Ibadan, University of Ibadan.

Osunlaja, SO, Ayanlaja, SA, Akinyemi, JO (1997). Introduction to Nigerian Agriculture in Essentials of General Studies, Odugbemi, O. O,: Balogun K. A.; Adebanjo A. and Adedoyin S. F. (eds) Published by CESAP, Ogun State University, pp. 108-124.

Rhaji, YM (1996). 'Socio-Economic Characteristics of Small Holders in Oyo State'. An Unpublished Ph.D. Thesis. Dept., of Agricultural Economics, University of Ibadan.

Riscopoulos, S, Mukanyanga, J, Cuyanux, O (1989). 'Agriculture in the year 2000, the case of the African Carribean Pacific Countries, International Forum Athens. Central Bank of Nigeria (CBN): 'Annual Report and Statement of Accounts, Lagos, Nigeria.

Rosen, S, Shapouri, S (1994). "Food security and the Role of Food Aid" In International Agriculture and Trade Reports Food Aid needs Assessment, United States Department of Agriculture.

World Bank (1988). Poverty and Hunger Issues and Options for Food Security in Developing Countries, Washington D. C.