MAIZE AND THE MALNUTRITION CONUNDRUM IN SOUTH AFRICA

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SUMMARY

In this paper, the author gives an overview of the factors leading to maize becoming a staple food among black people in South Africa. The purported relationship between maize consumption and malnutrition, proposals as well as experimental and practical efforts to correct the dietary deficiencies of maize are briefly sketched. With reference to the historical context in which maize became a staple food in South Africa, it is concluded that the consumption of maize is not to be blamed for malnutrition in South Africa.

Rappaport's theoretical principle of ecological logic and its relationship to culture contingency is used to indicate that the causal factors of malnutrition are to be found in the colonial political-economy of South Africa and in the monetary logic embedded in a racially skewed free market system of production. Currently, the South African Government is addressing the problem of malnutrition in a more integrated manner than in the past. However, the question remains whether a globally victorious and untransformed free market system of production affords an environment in which local efforts to solve the problems of malnutrition and poverty can be successfully executed.

KEY WORDS

Maize, Malnutrition in South Africa, Nutritional Policy

The Origin and Spread of Maize

Maize, also know as Indian corn, was regarded as the most important cereal crop in pre-colonial America. The domesticated form of maize probably derives from a wild grass known as teosinte (Quin 1959:32). In Central or Meso America, it was already domesticated by 3500 BC (Benz and Long 2000:459). From the early 16th Century, it was popularised world wide and become like wheat and

rice, one of the major cereals in the world (Truswell 1959:2). By the late 20th Century it was consumed by at least 200 million people globally (Ad Hoc Panel 1988: 11).

Outside the Americas, it was first grown in the Iberian peninsula. The name used by white South Africans for maize, 'mealie,' is probably derived from the Portuguese milho (Truswell 1959:2). The earliest known indication of maize production by indigenous black farmers in South Africa dates as far back as 1750 – 1780, (late iron age) as archaeological finds have shown, at sites in the present day Kwa-Zulu Natal. It was probably came in through from present day Mozambique (personal communication, Prof. T.N. Huffmann). Quin, with reference to the observations made by early travelers in the interior of Southern Africa, came to the conclusion that maize was largely unknown to black farmers at the beginning of the 19th Century (1959:34). However, he also wrote that the first Dutch settlers were familiar with maize, known as "Turchse Tarwe" in the Netherlands. He added,

> *"In his diary of July 24, 1658, van Riebeeck recorded the receipt of a sample of maize grain from New Guinea. The ship which conveyed this grain, the Hasselt, also carried a number of slaves and to these the first culture of the crop was largely entrusted. The first trekkers carried it far northward..."* (1959:33).

According to Quin (1959:34) the relatively recent introduction of maize is also attested to by the fact that it was not used during the traditional crop rites of the Pedi and Thonga. However, it has been incorporated into the traditional crop rites of the Bhaca of the Eastern Cape (Hammond – Tooke 1962:17). Yet another indication of the relatively recent arrival of maize is the fact that the Pedi in the past did not practice seed selection with regard to maize. In the case of sorghum, quite a number of varieties were recognized amongst black farmers in general where seed selection was practiced (Quin 1959: 27-28, 37).

Despite its late arrival, maize has become the staple food of the majority of black South Africans, replacing sorghum (Quin: 1959:57). In the middle of the 20th Century, surveys indicated that in urban areas some of the large amount of maize eaten by black people was replaced by bread (wheat) (Truswell 1959:4,6). However, in 1965, Oudkerk reported that in a survey of 576 black parents and guardians of black

children in Pretoria and its environs. 94% used maize-meal every day in the form of stiff or thin porridge or stiff and thin sour porridge. Thin porridge is used during breakfast and stiff porridge for lunch and supper. Protein intake in the form of meat was low (1965:1149, 1150). A more recent survey in Gauteng found that amongst black school children, bread was the most frequently consumed breakfast food (Wolmarans et al 1995:106). However, in research on the feeding practices of 155 black infants born at the Kalafong Hospital in Pretoria where it was possible to follow-up 74 of the infants for a period of 15 months, it was found that soft maize-meal porridge was still the preferred supplementary food given to babies from the age of about 3 months, in addition to breast feeding. The majority of the infants were from disadvantaged urban communities (Delport, et al 1997:57-58). (cf. also Leary 1965:1157). Although the data are fragmentary, the consumption of maize as a staple, seems still to be important, especially in rural areas (cf. Wilson and Ramphele 1989:104-105). There seems to be a strong tendency to move away from maize consumption in urban areas. This is not surprising, in view of the fact that bread (wheat) is readily available from many retail outlets in towns and cities. Many retailers will vouch for the big demand for "half-loaves" of bread from black workers during ordinary working days.

As a whole, about 25% of the world's food maize is consumed in Africa (Ad Hoc Panel 1988:22). Harlan summarized the situation as follows,

> *"In most of West Africa, maize has not really become a field crop, it is a garden crop, grown in small patches.... In parts of East Africa, on the other hand, and in Southern Africa it has become the staple cereal. It fits a niche in which it will grow better with a little more rainfall than sorghum, and it is a niche that was not very well filled before maize became available"* (1995:57).

Although maize is not as drought resistant as sorghum, it is regarded as a highly adaptable and robust cereal. Some of the possible reasons for its fairly rapid spread, which may also account for its acceptance as an exotic import amongst indigenous people in Southern Africa, can be summarized as follows:

- It gives one of the highest yields per hour of labour spent
- It is protected against birds and rain by its husks
- It is easy to harvest and can be shelled by hand

- It stores well if properly dried
- It does not shatter and thus can be left standing to maturity
- It competes better with weeds than other cereals (Ad Hoc Panel 1988:9-10).

In the South African context, Quin also indicates that the natural protection against birds makes maize less labour intensive than sorghum and promoted its acceptance in South Africa amongst black farmers. He also points out that white employers, because of an inadequate supply of sorghum, use maize to feed their black labour force, a situation which may have further facilitated the assimilation of the new food (1959:57). Beinart in turn, with reference to Pondoland, indicates that the institutionalization of labour migrancy led to a change in family structure towards smaller families. Less labour was available for agricultural activities. During his research he was actually told that people stopped growing sorghum because they had fewer children to send to the fields to scare away birds (1980:87). (cf also Keegan 1988:117). Beinart also referred to the shorter growing season, a higher yield and better storage properties of maize as reasons why it became a favoured cereal crop amongst the Mpondo of the Eastern Cape (1982:50).

The growth of a wider market and the money economy during the 19th Century, also played a role in the trend away from sorghum, although maize was not the only crop marketed (Quin 1959:275) (Bundy 1983:212). Presumably, the demand for maize in areas occupied by whites was much higher than the demand for sorghum (cf Beinart 1982:50). Referring to the situation in Natal in the middle of the 19th Century, Slater (1983:158) states that white farmers were concerned about the monopoly in the supply of maize and vegetables to towns by black producers.

Other factors, in addition to marketing opportunities, also stimulated the production of maize. In Pondoland, the outbreak of rinderpest - a disease, the spread of which was associated with colonialism - killed most of the cattle by 1897 (Beinart 1882:48) (Dazak et al 2000: 443). These cattle losses, like others in the past, stimulated more intensive cultivation, whilst, at the same time, the South African War which disrupted white farming, raised the demand for grain. This led to a remarkable response in that many thousands of bags of grain were exported from Pondoland. It also led to other kinds of innovative

actions, like intensive mixed cropping and the acceptance of ox draught plough cultivation. By 1880 there were 1000 ploughs in Pondoland, increasing to 14000 by 1911 (Beinart 1980:87). This opportunity lasted for some time, until the markets for grain from black farmers lost out to the more developed white and yellow varieties of maize produced on white farms in the Transvaal and Orange Free State in the years after the War (Breinart 1982: 48, 49, 50-51). Black farmers in Lesotho also responded to external demands for grain. During the 1860s Lesotho was regarded as the granary of the Free State and the Cape Colony. After the discovery of diamonds in Kimberley, Basotho farmers responded with such zeal to export opportunities that missionaries became anxious that the material progress would endanger their religious convictions. In 1873 they exported 100 000 bags of grain (Parsons and Palmer 1977:21-22) (Ferguson 1990:113). A similar situation is also existed in the Herschel area in the Eastern Cape, where small farmers responded with enthusiasm to the market opportunities in the 19th Century (Bundy 1980). (cf. Bundy 1972, for an earlier general overview of the positive responses by black farmers to market opportunities).

Although pre-dating the intensification of white colonial rule in the 19th and 20th centuries, the introduction of maize, replacing sorghum as the staple food of blacks, is one of the relatively small but nevertheless significant aspects of the complexities of the changes brought about by the presence of colonial powers in Southern Africa. Whilst there may have been small pockets of resistance (cf. Quin 1959:34), it was fairly quickly accepted where ecological conditions were favourable for its production.

The acceptance of maize as a staple food may already, during its early production phases, have had some consequences on the nutritional well-being of indigenous producers. Beinart is of the opinion that the trend away from sorghum, probably made the bad years worse for producers, because maize was less drought resistant than sorghum (1980:88,90). Huffmann, even speculates that the dendrochronological (tree-ring) evidence of a period of high rainfall during the last part of the 18th Century in present day Kwa-Zulu Natal coincided with the introduction of maize. At the end of the 18th Century tree ring studies indicate a period of drought, which may have led to an agricultural crises or collapse, because maize is less drought resistant than sorghum and millet. This could have been one of the things that triggered for the events which became known as the time of great

unrest or Difaqane (1986: 293-294). These events, inter alia, gave rise to the Zulu empire and the creation of the Basotho nation.

Whatever the empirical status of the above speculations, the trend away from sorghum towards maize production is illustrated by figures supplied by Beinart for Pondoland (1980:89). According to these statistical estimates which Beinart warned should be regarded with some reservations, small farmers in Pondoland produced about 148 000 bags (200Lb's) of maize and 105 000 bags of sorghum during 1898. For 1923 the figures were respectively 588 668 bags of maize and 25 7000 bags of sorghum. In 1948, about 621 093 bags of maize and 10 023 bags of sorghum were produced. Production figures for South Africa as a whole, for the 1999/2000 season, according to the final estimate of the Crop Estimates Committee of the Department of Agriculture amounted to about 10 500 000 tons of maize as against 352 450 tons of sorghum (South African Government 2001).

Maize Consumption Patterns

Patterns of maize consumption within countries usually varies along a continuum from rich to poor. Amongst the affluent, the direct use of maize as human food per capita is small, whilst amongst the poor, high patterns of consumption, especially in rural areas, prevail (Ad Hoc Panel 1988:V11, Hamaker and Rahmanifar 1995:29, Truswell 1959:3, Van der Merwe 1995:8). In cases of dire poverty, a daily diet of maize and little else is to be expected. (Pretorius and Novis, 1965: 237-238) (Oudkerk 1965:1150).

In affluent societies, maize is preferably used as animal feed. From the point of view of energy, this is an extremely wasteful practice (Harris 1988:259). In the United States, where more than 30% of the total world tonnage of maize is produced, about 50% of the maize produced is used as animal feed and 25% exported (Saldivar and Rooney 1995:90). In South Africa the split in utilization of maize as human food and animal feed is about 50/50, with white maize used as human food and yellow maize used as animal feed (Gevers 1995:217).

The Nutritional Value of Maize

In the 1980's it was estimated that maize provided 15% of the global food protein annual and 19% of the world's food energy (calories). (Ad

Hoc Panel 1988:9). At the same time, about half of the world's population of undernourished people was using maize as a staple food (Ad Hoc Panel 1988:9). In these areas, maize provided about 80% of the energy and 70% of the protein intake of human consumers (Van der Merwe 1995:8).

Cereals in general are not complete foods. Both maize and sorghum lack biologically available niacine (nicotinic acid), a B-vitamin. The nutritional qualities of sorghum are indeed somewhat poor in comparison to maize (Hamaker et al 1995:277).The lack of niacine can give rise to the deficiency disease pellagra, a disease with the clinical symptoms of dermatitis, diarrhea and dementia.

The low amount of niacin in maize results from the high percentage of the leucine protein fraction that interferes with the conversion or biosynthesis of the amino acid tryptophan into niacin (Ad Hoc Panel 1988: 32). The global epidemiological pattern of pellagra is closely linked with areas where maize and sorghum constitutes the bulk of the diet (Ad Hoc Panel 1988: 15). (Cf. also Statigos, J.D. and Katsambas, A. 1977:100). Maize, like other cereals, also does not contain Vitamin C (Paes and Bicudo 1995:69).

Maize contains more or less the same percentage of amino acid as most other cereals. In comparison to legume seeds like beans, maize is low in protein. The maize kernel contains about 9-11% of protein on average (Clover 1992:10). Maize protein is also comparatively deficient in the essential amino acids, lysine and tryptophan – also called the limiting amino acids in maize. This deficiency and the general low protein content is an important factor in the prevalence of malnutrition, especially acute kwashiorkor, amongst infants in communities with maize as a staple food (Van der Merwe 1995:8).

The above, natural limiting factors in the nutritional properties of maize, can be exacerbated by cultural practices. In South Africa, most maize, about 70% consumed by humans, is in the form of refined products produced by commercial millers. (Du Plessis et al 1971:536). According to Truswell, the results of the milling process are as follows:

> *"When maize is milled into refined (de-germinated) meal the germ and pericarp are lost. When it is made into samp the aleurone is lost as well. In these products, there is little left but starch and a small amount of very unbalanced protein"* (1959:32).

In the popular, so-called super maize meal, 14% of the protein and 60% and more of the fat, minerals and vitamins are lost after removal of the outer coat of the kernel and especially the germ (Van der Merwe 1995:11). An important reason for de-germination from the millers point of view, is that it is regarded as a key step in the efficient dry milling of maize (Saldivar and Rooney 1995:97). Although commercial milling implies that refined products can be enriched or fortified at milling points, this constitutes a big departure from the use of ground whole maize or sorghum meal, with enhanced nutritional value, as was practiced amongst earlier black farming communities (Quin 1959:138, 189) (Du Plessis et al 1971:536).

From a nutritional point of view, the cultural preference in South Africa for the white varieties of maize can also be regarded as a matter of concern. Yellow maize has relatively high levels of carotenoids, plant pigments that give rise to vitamin A in the human body (Ad Hoc Panel 1988:49). This is not present in white maize. However, small amounts of yellow maize is consumed in the form of corn on the cob (Quin 1959:245). It is also known that in some rural areas in KwaZulu Natal, yellow maize is acceptable as human food when white maize is not available (Van der Merwe 1995:11).

Efforts to Overcome the Nutritional Deficiency of Maize – Traditional and Modern Technology

Amongst scientists, the awareness of problems regarding the nutritional value of maize dates back to the 19th Century. Truswell (1959:25) refers in this regard to a classic long term experiment to enhance its nutritional quality. In 1896, at Illinois in the United States, a programme was initiated to breed a maize variety with a high protein content. By 1950, after 50 generations of inbreeding, a high protein maize with more than 19% protein was created. However, it was not commercially viable. This led Truswell to conclude, a prediction he shared with others, that the prospect for breeding maize with high levels of lysine and tryptophan, did not appear good (1959:27) (cf also Kodicek et al 1956:65). This prediction was soon afterwards proven wrong.

From a survey of relevant literature, it seems that there are at least three techniques that may be used to enhance the nutritional quality of maize as food and feed. The techniques can be classified as:

- learning from and using indigenous knowledge

- the artificial fortification or enrichment of maize by the addition of amino acids and other nutritional additives like vitamins and minerals
- genetic manipulation by breeding and hybridization

Learning From Indigenous Knowledge[1]

From the perspective of the use of indigenous knowledge as a technique to enhance the nutritional value of maize, it is interesting to note that when maize spread from its locality of origin, the processes for its preparation into food did not spread concurrently, at least not to Africa.

One of the possible problems which arise in this regard concerns the bulky nature of the diet of maize porridge used in South Africa, especially considering its use in the feeding of small children. According to Dreyer et al, maize porridge contains at least 70% water. Taking the energy needs of a child of 2 years as a benchmark, the child will need about 317grams of sifted granulated maize meal per day. This translates into a capacity for about 1kg of stiff porridge per day. According to Dreyer et al, this will restrict a child's ability to consume the amount of calories needed. The caloric density of ordinary porridge is less than that of the traditional American tortilla which contains less water and is a better food than maize porridge (1965:1167).

However, of significance, other than the property of caloric density of the tortilla in comparison to maize porridge, is the hypothesis the Mexican physician Ismael Salas put forward in his thesis submitted to the University of Paris in 1863. He stated that the particular way in which maize is prepared and cooked by the people in Meso-America was responsible for the absence of pellagra in Mexico and Central America, where maize was, and still is, a staple food (Hugill and Dickson 1988:34).

The Salas hypothesis has been tested experimentally, with positive results. The "secret" of the traditional process is the alkali (lime) processing of maize, also called hydrolysis with NaOH. Alkali treatment may be regarded as a way of "enriching" the nutritional value of maize. Amongst aboriginal American societies which depend on maize as a staple, observations indicate that they use various sources as an alkaline medium, including slaked lime, wood ash or lye, green

roasting, burned gastropods or mollusk shells and ash roasting (Hugill and Dickson 1988: 34-35) (cf. also Katz et al 1974:772).

An indirect confirmation of the value of alkali processing was made in the comparative study by Katz et al (1974) in which the maize processing methods of 51 aboriginal American societies were studied. The comparison was undertaken to test the hypothesis that when large amounts of maize are consumed by people, alkaline processing is essential, especially amongst children who are unable to consume enough maize to compensate for its nutritional deficiencies. They believed that the hypothesis was strongly confirmed by their finding that,

> *"There is a striking, almost one-to-one relationship between those societies that both consume and cultivate large amounts of maize and those that use alkali treatment. On the other hand, those societies consuming and cultivating smaller quantities of maize almost invariably do not use alkali cooking techniques".* (1974:770).

It is assumed that the alkali processing practiced in the Americas came about because the hard kernels of maize were softened by pre-processing with lime water, and not necessarily because of knowledge about the chemical transformation lime treatment brings about (Ad Hoc Panel 1988:16).

Hugill and Dickinson quote from a report of the UN Food and Agricultural Organization (FAO) regarding the chemical effects of alkali treatment which states that pre-treatment with lime frees the essential amino acids, lysine and tryptophan, in the gluten fraction of maize protein. The process also improves the amino acid balance between leucine and isoleucine and adds potassium, magnesium, copper and zinc and can increase the calcium content by more than 2000%, iron by 37% and phosphorous by 18% (1988:34).

In an extension of work initiated in the late 1940's and early 1950's, Kodicek et al in 1956 published results of an experiment with pigs which have a nicotinic acid metabolism similar to that of humans. The experiment was undertaken to test the anti-pellagragenic effect of alkali-processed maize. During the experiment the pigs were first given a normal maize diet without any supplement, until they developed scouring, and ceased to gain or lose weight. Of the three groups of pigs

in the experiment one group was fed a reconstituted maize diet of hominy (hulled, crushed and boiled) meal and bran hydrolyzed with 0.5 n-NaOH (alkaline processed), another group was fed hominy meal and bran, supplemented with 6mg nicotinic acid given daily by mouth, and the third group hominy meal and bran only. The reported experimental results were that the pigs that were given the maize diet only, remained deficient and two died before the end of the experiment. The group given alkali treated maize recovered from their original deficiency and actually gained on average 1362g (3lb) of weight per week. The pigs given maize supplemented with nicotinic acid fared even better, they recovered and gained 2270g (5lb) of weight per week. Examination of the pigs by the end of the experiment indicated some signs of vitamin E deficiency amongst the pigs fed with the hydrolyzed meal. However, the authors concluded,

> *"It is suggested that the liberation of nicotinic acid by alkaline hydrolysis, confirmed also by paper chromatography, was mainly responsible for the recovery of the deficient pigs when given a diet containing the alkali-hydrolyzed milling fraction of maize, which had all its nicotinic acid in free form"* (1956:65-66).

With regard to the experiment's implications for human nutrition, Kodicek et al concluded that because nicotinic acid in maize is present in an unavailable, 'bound' form, it explains the high incidence of pellagra in those on certain maize diets and the absence of deficiency on rice diets. They added that it was tempting to promote lime-water treatment for maize to enhance the nutritional value of maize in areas where the process is unknown, but that further study is needed (1956:65).

However, the beneficial effects of the nutritional value of maize lime cooked and then baked into tortillas in the traditional way, by rural housewives in Guatemala, have recently been re-established (cf. Bressani et al 1990:515-518).

It must be added, and although no empirical evidence is available, that processing maize into traditional tortilla is perhaps more labour intensive and higher in energy input than the traditional preparation of maize porridge because it must be cooked twice.

The dietary value of alkali treatment of maize has been known for some time in South Africa. Quin refers to the process as the fortification of maize with lime, enhancing its calcium content, without reference to its influence on protein availability (1959:251). In a report by the National Nutritional Research Institute (NNRI) of the Council for Scientific and Industrial Research (CSIR) on the supplementation of maize, published in 1961, the authors referred to the work done by Kodicek and associates and also to work by NNRI-researchers, that niacin can be liberated by alkali treatment. However, the authors were of the opinion that the free niacin content of maize could be increased even more cheaply by the addition of niacin or its amide form to maize meal (CSIR Report, 1961:4). (cf. also Truswell 1959:67).

The Artificial Enrichment of Maize

The artificial fortification of food is a complex issue. This is clearly illustrated in reports on the possible techniques involved, the reasons for and extent of fortification (cf. Joint FAO/WHO Expert Committee, 1971) (CSIR Report, 1959). Fortification may be described as the process whereby nutrients are added to foods to maintain or improve the quality of the diet of a group, a community or a population. It includes inter alia the fortification of salt with iodine or the addition of extracts or concentrates of materials of biological origin or of chemical or biochemical synthesis to foods (Joint FAO / WHO Expert Committee 1971:9).

Historically, scientifically formulated food fortification practices started in the 20th Century. From the 1920's, when more knowledge was gained about nutritional problems relating to vitamin deficiencies, fortification of food with vitamins in the form of concentrates or in synthetic form became popular. During the 1940's, the fortification of wheat and maize products was introduced, particularly enrichment with the B-vitamins thiamine, niacine, and riboflavin. During the Second World War, undermilled wheat flour was used with the addition of calcium in the United Kingdom to increase the nutritional value of bread. In the East, rice enrichment also became popular during the 1940's (CSIR 1959:2-4). (Joint FAO/WHO Expert Committee 1971:12-13). By the 1970's it was estimated that more than 250 million people in the western world eat vitamin-enriched bread (du Plessis et al 1971:530).

In the 1950's, attention was shifted towards protein deficiencies especially after the "rediscovery" of kwashoikor in Africa by experts of the World Health Organisation (Joint FAO / WHO Expert Committee 1971:34) (McLaren 1974:93-96) (Hegsted 1978:62). In this regard Hegsted writes,

> *"A great deal of time, effort and money has been spent in attempts to deal with the supposed protein deficiency – for instance, many efforts to produce high-protein foods or supplements for children, to upgrade the protein content of cereals by genetic means, and to supplement cereals with proteins or amino acids. As late as 1971 the United Nations published a report entitled "Strategy Statement to Arrest the Protein Crisis in Developing Countries", Efforts of this kind continue".* (1978:62).

However, the Sixth Joint FAO/WHO Expert Committee on Nutrition, during its 1962 session, already acknowledged the nutritional complexity involved in malnutrition and coined the concept, "Protein-Calorie Deficiency Disease" or "Protein-Calorie Malnutrition" (PCM) as a convenient shortform (Joint FAO/WHO Expert Committee 1971:36). This concept was later changed to "Protein-Energy Malnutrition" (PEM), currently in general use (Alleyne et al 1977) (cf. also McLaren 1974:93).

Health authorities in South Africa also took note of international trends regarding the fortification of food. The National Nutritional Council in 1948 indicated that it was favourably disposed towards the idea of the fortification of maize meal. This proposal was rejected (Draft Report 1994:5).

In a CSIR research report in 1959, issued after earlier recommendations by the National Nutritional Research Institute (NNRI) on food enrichment, reference was made to the launch by the FAO/WHO and UNICEF in 1949 of a programme to prevent protein malnutrition amongst infants and young children. Specific mention was also made to kwashiorkor and allied diseases (CSIR Report 1959:1). In the CSIR Report, a thorough study of the principles of food enrichment with special reference to the use of fish flour for the protein enrichment of bread is presented and, a brief history is sketched of food fortification internationally and work done in that regard in South Africa. In the

report, mention is made of work done overseas and locally to produce a deodorized fish flour as a protein supplement. It is stated that the South African Minister of Health, Karl Bremer, stressed the need in 1951, for measures to combat malnutrition. This led to a decision in 1952 by the newly formed Department of Nutrition, that defatted groundnut flour, skimmed milk and calcium should be used to fortify brown bread on a national scale, until work on the fish flour process, already started in 1937, could be perfected. In 1956 brown bread enriched with fish flour was experimentally released for consumption in the then Western Province with a view to later extending it nationally. Subsequent to this experiment, the Advisory Committee for Nutrition Research of the CSIR decided that the extension of the programme should not be considered until all the evidence for or against such a step, and the principles involved in a national enrichment scheme had been reviewed. (CSIR Report 1959:1).

In its recommendations, the CSIR report, inter alia, concluded that although research in food enrichment and the use of fish flour should continue, but that there was no scientific justification for the extension the fish flour enrichment scheme to the whole nation or for the continuation of the initial scheme to enrich brown bread. The scheme was judged to fail to meet many of the 9 basic principles of an effective enrichment policy. It also called for a programme to prevent kwashiorkor amongst children, by the distribution of skimmed milk powder directly to needy white (European) and black (non-European) infants. It was recommended that extensive investigations be launched to find the best conditions under which maize can be employed as human food, since maize is the staple of blacks, especially those in rural areas. More attention should also be given to public health education, and permanent machinery should be established by the state to gain information on the nutritional status of the population (CSIR Report 1959:144, 146-7).

In 1961, a follow-up report was issued by the National Nutrition Research Institute (NNRI) of the CSIR in which the central theme addressed was the supplementation of maize in South Africa (CSIR Report 1961:1-8). The main thrust of the report was that further research was needed before enrichment schemes could be embarked upon. In the report the attention of the authorities was also drawn to Clause 12(8) of the Food, Drugs and Disinfectants Act (Act No. 13 of 1929) which prevented the enrichment of maize meal with synthetic vitamins. It recommended that the clause will have to be amended if

feeding trails show that maize enrichment with synthetic niacin - to prevent pellagra - was found to be desirable. The report also mentioned that although milk and milk powder is effective in preventing kwashiorkor which occurs widely amongst black children, milk supplies in South Africa were inadequate to meet the need. Further work on possible protein sources is therefore needed. It was also stated that food policies aimed at greater production and the distribution of the supplies of certain foods may in many instances be found to be more satisfactory than enrichment schemes (CSIR Report 1961:7).

In 1964, a request by the opposition in Parliament for the fortification of maize was not responded to (Draft Report 1994:5). However, earlier in 1962, as a result of the efforts of the opposition in Parliament, kwashiorkor became a notifiable disease (Draft Report 1994:3). Six years later, in 1968, the notification was stopped and the then Minister of Health, Dr Hertzog, indicated that it was no longer necessary and that the situation was under control (Draft Report 1994:35).

However, research and experimentation on the fortification of maize was continued. In 1971, Du Plessis et al (1971:534-537) published the results of research done on the fortification of maize meal with riboflavin and nicotinamide. The research also included a test of the technical feasibility of the supplementation of maize meal at the milling point as well as the nutritional effect of the consumption of the enriched product on the nutritional status of rural black children, in what is now the Northern Province. They reported positive, although not conclusive, results in regard to pre- and post experimental subclinical signs of malnutrition amongst the children. No serious technical problems were experienced at the mill itself where the supplement mix was fed into the maize meal. They also calculated that the cost involved to fortify all maize meal used for human consumption in South Africa with adequate amounts of riboflavin and nicotinic acid, would be about R570,000 per annum.

In the 1960's, the NNRI also started work in the formulation of a protein-rich food for children (Dreyer et al 1965:1168-1169) (cf. also CSIR Report 1961:7). In 1975, the Department of Health began to subsidise a product enriched with proteins, vitamins and minerals, designated PVM, for distribution to clinics. This was supplementary to a scheme in which local authorities throughout the 1960's were subsidised with milk powder to combat malnutrition amongst children

under the age of six. During the 1960's, the annual budget for the PEM scheme amounted to R90,000 (Draft Report 1994:5).

In 1976 the South African Medical Council assembled experts to report on all aspects of food fortification. Their findings were reported in 1978. In the summary report, as published in the South African Medical Journal (Report of a Medical Council Research Project Group 1978:744-750), it was concluded that the following fortification proposals must be implemented immediately:

- The fortification of maize meal with riboflavin and nicotinic acid.
- Fortification of maize meal with folic acid, a recommendation dependent on the proposed fortification of maize meal with riboflavin and nicotinic acid.
- The restoration of the vitamin A content of skimmed milk powder.
- The fortification of all processed and evaporated milk with vitamin D.
- The fluoridation of water supplies in areas low in fluoride intake.

The Project Committee also took cognizance of the fact that the Department of Health had approved the idea of compulsory enrichment of maize meal with riboflavin and nicotinic acid, at a total cost of about R460,000 per year, but that the Treasury had turned down the request. The members of the Committee indicated that according to their own calculations of only direct costs involved in such a scheme, a very strong case on purely economic grounds could be made for a national fortification scheme. They added,

> *"No attempt was made to estimate the economic implications due to lack of productivity of pellagra patients during the period of illness, or the implications of reduced working capacity as a result of sub-clinical deficiency. The Committee also agreed that with the present economic tendency ... individuals in the lower socio-economic groups would be relying to a greater extent on the exclusive use of the less costly basic staple foods, of which maize is probably the most important"* (1978:747).

The Committee acknowledged the evidence for protein and energy deficiencies amongst the black population, which manifested itself in

the form of kwashiorkor and marasmus and a great deal of evidence on diseases associated with malnutrition, like gastro-enteritis, pneumonia and tuberculosis as well as growth retardation. They recommended that more research should be undertaken. They also indicated that because of the costs involved, the universal fortification of maize meal with protein could not be recommended, although specific groups may be targeted if energy deficiency is demonstrated (1978:74).

Nevertheless, they recommended that projects of the highest priority should include, amongst others, the improvement of nutrition and health education, the distribution of protein supplements to clinics, research on protein enrichment of maize meal with soya, vegetable protein or whey powder. The testing and development of high lysine maize was also recommended.

The above report was published after an announcement that the government's involvement in maize fortification was no longer needed, since enriched maize meal had become commercially available. The enrichment of maize meal has since been undertaken on a voluntary basis by milling companies. Milling companies are not, except with regard to labeling and specification of specific products, subject to control measures, and the efficiency of enrichment is largely unknown (Draft Report 1994:5, 16).

The disinterest indicated by the government, did not deter researchers in the fields of health and nutrition to continue their study and make recommendations for the fortification of maize meal during the 1980s (cf. Van der Westhuizen et al, 1986:143-146; Baynes et al, 1986:148-151). In the same issue of the South African Medical Journal that carried the above reports regarding the disease patterns encountered because of folic acid deficiency, a causal factor in megalobastic anemia and a higher incidence of prematurity, Metz wrote the following in the editorial pages,

> *"Some 15 years after recommendations that maize meal be fortified with nicotinic acid and riboflavin, some meal so fortified has become available from millers, but folic acid is not added. Apparently the small amount to be added presents technical difficulties. The cost ...would also be higher, although the increase would only be 4c for a 81.5kg bag ... The processing of maize is controlled by law through the Maize Board and the Government has been asked to legislate that the milling industry replace those B vitamins*

> *the processing removes ... The Government has declined to do so, claiming that the implementation would be difficult to monitor. Instead, it is expected of the milling industry to act in a responsible manner by voluntarily fortifying the meal. Not all share this confidence in the milling industry's sense of responsibility even when minimal inconvenience and increase of cost are involved."* (1986:132)

The doubt expressed by Metz whether a voluntary programme could be trusted unconditionally, was to a certain extent confirmed by the work of two researchers from the Department of Health and Population Development. They analysed enriched maize meal available from retailers and concluded that the concentration of riboflavin and niacin varied, not only from different mills, but also from the same mill. According to them, the consumption of fortified maize meal also declined from an estimated 25.2% in 1986 to 17% in 1989. They also found that during a pilot study of black school children, which formed part of their research project, more than a third of the children showed subclinical signs of riboflavin and / or niacin deficiency (De Hoop and Kotze, 1990:5-6). However, in a somewhat contradictory way to the pronouncement regarding the efficacy of voluntary maize meal fortification in the 1994 Draft Report of the Nutritional Committee to the Minister of Health, it is stated that voluntary fortification of maize meal with niacin and riboflavin appears to have reduced the prevalence of pellagra (1994:12).

According to Steyn (1996:148), vitamin A, iron and iodine are presently receiving global interest as priority areas within the context of fortification and supplementation of food. Deficiencies in these micro-nutrients are implicated in significant morbidity rates, growth retardation, negative effects on work capacity and diminished cognitive development. It also became one of the objectives of the Nutritional Committee of the National Nutrition and Social Development Programme (NNSDP) to eliminate iodine deficiency disorders by the year 2000. In 1995 legislation was passed to make it compulsory for all salt used for human consumption in South Africa to be fortified. Work is also underway with regard to fortification and supplementation to address vitamin A and iron deficiencies, based upon recommendations made by the South African Vitamin A Consultative Group (SAVACS) in 1995. (McLachlan and Kuzwayo 1997:41) (Steyn 1996: 151-153).

The Genetic Manipulation of Maize [2] [3]

The breeding of hybrid varieties of maize and their use to enhance production in South Africa can be regarded as part of the so-called Green Revolution which came about around the 1960s (Emmett 1990:18) (Verbeek 1976:50) (Parsons and Palmer 1977:8-9). Hybrid varieties of cereals, in conjunction with the use of pesticides, herbicides and fertilizers brought about big increases in grain production. It was especially successful in Asia (Hayami and Otsuka 1994:18). Scientific investigations also, despite doubts expressed in the 1950s, led to a breakthrough in the breeding of maize high in protein quality. In 1963 scientists at Purdue University found a mutant maize with more or less the same percentage of protein, but with about twice the levels of the essential amino acids, lysine and tryptophan, in its endosperm than ordinary maize. The discovery coincided with the stress placed on protein malnutrition in world health forums. This variety of maize became known as Opaque-2, because its kernels were soft and not transparent when placed on a light box (Ad Hoc Panel 1988:18).

The news about this development was received with enthusiasm in a number of maize producing areas, and breeders started to transfer Opaque-2 genes into local maize varieties. In the United States the production of Opaque-2 rose from zero in 1970 to about 240 000 tons by 1975 (Ad Hoc Panel 1988:19).

Experiments with Opaque-2 soon established its excellent potential as food and feed. It was found that it had 80-90% of the value of milk protein, as against 39% for normal maize. In animal trials, it was found that piglets fed on Opaque-2, supplemented with vitamins and minerals gained 1797g (+/- 4 lb) of weight per week, as against 21g per week when fed with supplemented ordinary maize (Ad Hoc Panel 1988: 50-51).

Children with acute forms of malnutrition like instances of kwashiorkor, were cured by replacing their normal maize diet with a diet consisting of Opaque-2 maize meal as the only source of protein (Mertz 1995: 4-5). It is also significant that this means that for humans with maize as a staple diet, and especially children, the bulk of maize meal consumed to reach nitrogen balance (an indication of adequate protein intake) can be reduced quite substantially (Van der Merwe 1995: 8-9). In the case of small children, a daily consumption of 175g of Opaque-2 maize guaranteed nitrogen balance (Ad Hoc Panel 1988:52-53).

However, already in the 1970s, most agricultural research centers and companies involved in hybrid seed breeding, abandoned their research on Opaque-2 (Mertz 1995:5). By the end of the 1970s its commercial value became thoroughly discredited. The main reason for this state of affairs concerned to its poor agronomic qualities, including the following (cf. Ad Hoc Panel 1988:19-20):

- Its yields were 8-15% lower than those of other hybrids
- It was more susceptible to attacks by disease and insects, both in the field and in storage – a problem for both farmers and millers
- It dried more slowly than normal maize
- Its kernel weighed less because of the air spaces surrounding its loosely packed starch granules
- Consumers resisted buying it because of its soft, floury texture and unconventional chalky appearance

Nevertheless a few research and development centers kept on working to try to overcome the agronomic deficiencies of Opaque-2. They were (Mertz 1995:5-6):

- The "Centro Internacional de Mejoramiento de Maiz y Trigo" (CIMMYT) (The International Maize and Wheat Improvement Centre) in Mexico. An institution known for researchers like Norman Borlaug, who received the Nobel Prize in 1970 for his work in developing high yield wheat.
- The Grain Crops Institute in Kwazulu-Natal. At this institute the development work was driven by the now retired Dr Hans Gevers, since 1965.
- Crow's Hybrid Corn Company, Milford, Illinois, in the USA. This company is the only one which makes improved Opaque-2 hybrids available to farmers in the Midwest of the United States.

These institutions succeeded during the 1980s to overcome most of the agronomic problems of Opaque-2. Researchers were able to produce white and yellow varieties that combine the nutritional properties of Opaque-2 with agronomic qualities that compared very favourably with those of other maize hybrids. The new varieties became known as Quality Protein Maize (QPM), also referred to as high lysine maize (Ad Hoc Panel 1988:20-24) (Gevers 1995: 217-229). However, in the cultivation of QPM it is still necessary to ensure its isolation from

ordinary maize, because pollination of QPM by ordinary maize results in the loss of the nutritional characteristics of QPM (Van der Merwe 1995:7).

In South Africa, news of the development of the original Opaque-2 maize was well received. A technical advisor of the South African Maize Board, Prof. F Laubscher was actually present during the announcement of the successful breeding of Opaque-2 in the United States. The Maize Board and the Department of Agriculture - Technical Services initiated and supported local breeding programmes during the 1960s (Anon. 1970). Seeds of the first locally produced white QPM hybrid, known as HL1, were released in 1979 for commercial production whilst the first QPM yellow hybrid, known as HL2, was released during 1982. Both varieties were regarded as competitive yielders. Since then, varieties of GPM have continued to be tested and released (Van der Merwe 1995:2).

Van der Merwe also reports that on-farm evaluations of QPM were undertaken by the Institute of Natural Resources (INR) at Vulindlela in Kwazulu-Natal amongst 25 emergent rural farmers during the 1993/94 season, with a yellow QPM – hybrid known as NS9100. The yield obtained was high. The farmers also reported that the yellow QPM provided excellent green mealies, maize bread and meal for household consumption, but did not make good samp (1995:11).

Despite the much improved agronomical characteristics of the latest varieties of QPM, which can be regarded as being on par or better than those of many ordinary hybrids, it has not become a commercial success in South Africa. The reasons for this are complex, but seem mostly related to constraints within the commercialized market economy. An initial problem with the first white QPM, HL1 was that although it fared much better agronomically than the original Opaque – 2, it failed commercially because it still had a relatively soft kernel. It was therefore not acceptable to the dry milling industry in South Africa. The millers prefer hard-kernelled maize with, what are regarded as good granulation characteristics, for the production of refined meal, mealy rice and samp (Van der Merwe 1995:17). By 2001, no commercial white QPM was available (Personal communication, Dr. H Gevers, March 2001). However, it is perhaps interesting to note that soft kernelled grain does not imply its unacceptability under conditions of more traditional processing. If an analogy with sorghum can be used, Harlan writes with regard to the use of sorghum in Mali, West Africa,

> *"In parts of Mali where they grow both the soft seeded variety and the hard seeded sorghums, women do not like to pound the hard seeded variety because it is hard work, but they still grow it because it has high insect-resistance in storage. It is therefore saved for the latter part of the season and they eat up the soft sorghum first"* (1995:56).

Perhaps, only relevant as a historical footnote, Quin also refers to the fact that amongst the Pedi, softer varieties of maize are preferred owing to greater ease of grinding (1959:37).

The fairly limited official support given to the production of QPM also did not bear fruit. In the early 1980s the Maize Board agreed to accept QPM provided it was delivered to existing bulk storage depots, and separate silo's were made available for this purpose. But not enough maize was delivered for successful utilization. According to Gevers, this was a problem inherent in the one-channel marketing system of maize, a system which has since been discontinued (1995:225) (Van der Merwe 1995:18).

According to a spokesperson of the animal feed industry, the South African animal feed industry regards maize as its greatest source of protein. All measures to improve the quality of protein in maize are welcomed by the industry. However, the non-use of QPM is as a result of the following problems:

- only limited quantities are irregularly available.
- silo limitations with regard to separate handling. At feed factories, separate silo space is necessary to store different raw materials. Limited quantities of QPM causes problems.
- the necessity to change feed formulas every time maize with different protein content becomes available.
- difficulties to differentiate QPM from ordinary maize, making it impossible to ensure that the correct product is received and used.

He is of the opinion that these problems can only be solved if all producers start growing QPM and when maize is sold on a protein basis like fishmeal, in a real free market system (Van Niekerk 1994:13) (My translation).

Gevers also states that it is claimed that QPM is no longer necessary in South African because a newly built synthetic lysine factory will be able to provide local protein needs. He rejects this attitude because he is of the opinion that the synthetic product will probably cost the same as the imported product and that consumers may react adversely towards the synthetic product (1995:227).

Presently, the retired Dr Gevers is the only developer of QPM in South Africa. He undertakes the work in his private capacity, without any external financial support. However, QPM seeds are made available to farmers in South Africa through the private sector firm Agricol. Interest is mainly in yellow varieties of QPM and is probably mostly used on-farm by commercial farmers as animal feed (Personal communication: Dr H. Gevers, March 2001). In a recent interview with a correspondent of the "Farmer's Weekly", Gevers also expressed the opinion that there are signs of a revitalized international interest in the promotion of QPM (Byford-Jones 2001:15). Globally, with the inclusion of Ghana, China, Brazil and Mexico, QPM is cultivated on about 1 million hectares (Personal communication Dr H. Gevers, March 2001).

From the above selective and broad historical survey of the relevant literature, it is clear that during the past century, a lot has been learned about human nutritional needs. In South Africa and within the broader context, continual concern has been expressed over at least 60 years, about maize and its deficiencies as the staple food of the poor. A substantial knowledge base has been established and large amounts of money, time and energy have been spent on researching the problem of enhancing the dietary value of maize. Despite all these efforts and recommendations, direct government action in this regard has largely remained a dead letter.

In the next section, I will try to show that although the treatment of symptoms is necessary, this inaction from especially the time during the apartheid years, was ironically and most certainly for the wrong reasons, perhaps a kind of blessing in disguise in the face of the problem of malnutrition. A problem which is only began to receive full and comprehensive attention from since the 1990s.

Malnutrition: Is Maize the Culprit?

In the above overview, the role of maize as the staple food of the poor in South Africa has been emphasised, with reference to experimental efforts and recommendations to the authorities about ways to overcome the nutritional problems associated with a maize diet. However, this can create the impression that maize was regarded as the main cause of malnutrition. To create this impression will do a serious injustice to probably the majority of researchers who on the basis of their training and expertise focused their attention rather narrowly on research to enhance the nutritional value of maize.

It is also not true that there was no criticism of the Apartheid Government, its structures and policies amongst nutritionists. This can be illustrated with reference to the presidential address by Dr. F.W. Quass during the Congress of the South African Nutrition Society in April 1965. In his wide ranging talk on the South African nutritional situation, with some reference to food enrichment, he took the government to task for the gaps in its nutritional policies. He indicated that since the state acted upon the recommendation of the so-called Mönning Committee of 1958 to disband the Department of Nutrition and the subsequent transfer of the State's nutritional activities to the Department of Health and the Department of Agriculture Technical Services, efforts to improve the nutritional status of the population was weakened. He added,

> *"Nutrition has been treated like Cinderella by the two .... Organizations. The Department of Health consistently disclaims any responsibility in regard to the assessment of the nutritional status of the various ..... groups of the country, and the Department of Agriculture Technical Services is necessarily more concerned with the nutrition of animals than man!"* (Quass 1965:1141).

In his address he also criticised the State's subsidy of white bread, although he realized that the subject was "political dynamite" (1965:1135). He also proposed that the scheme in which the state subsidized powdered milk to combat kwashiorkor and which reached 100 000 infants in 1964, should be extended despite the milk shortage in South Africa. At the same time, he criticized the proposal in

Parliament, that all maize should be enriched with milk powder, in view of the fact that milk is a spoilable product. He added,

> *"If fortification is to be rational it must ... satisfy an established need, otherwise the measure is very likely to be wasteful. We need all our milk powder for the toddlers, vulnerable to kwashiorkor – mainly Bantu and we certainly should not 'waste' any of this wonderful food on .. the privileged classes"* (1965:1140).

However, despite his remarks that indicated compassion for the poor, the main theme of his address related to food availability (Quass 1965:1136-1141).

The problem of malnutrition was not denied, but the general impression is that during the period from 1950 to the 1970s, the predominante ideas expressed were that the problem must be solved by Government policies that facilitate the distribution of supplements and more food to the needy. In this regard, and with the prevention of pellagra in mind, Du Plessis et al wrote in 1971,

> *"Ideally pellagra should be prevented by improving the diet by means of natural foods. From a social, educational and economic point of view this would be virtually impossible to accomplish since this would entail drastic changes in the basic dietary habits of the Bantu population. It would, therefore, be much easier to add the two vitamins to a staple food such as maize....."* (1971:530).

This quotation is perhaps more interesting in what it left out, rather than in what is spelled out specifically. Must one, for instance, presume that the infrequency of pellagra amongst the white population is related to "habits" of consuming more "natural foods"? It also implies that the black population if enabled to change their habits or add to their diet, will refuse to do so - indeed a very contentious view and truncated historical perspective, as was briefly indicated earlier in this paper. Underlying causes of nutritional problems that relate to the socio-economic structure of society or the political-economy of South Africa, as already indicated by medical experts like Kark (cf. Kark 1950:23-37) in the 1940s from his experiences with the rural poor, are also seen as

too difficult to address. Distributional and technological fixes are promoted, perhaps, because a much broader based approach was regarded as "political dynamite". It was politically much safer to medicalise the problem, by using food supplements as medicine.

In the 1980s, a change in the conceptualization of the problem of malnutrition became apparent. This is, in a small way, reflected by a response by Metz and Van der Westhuizen to criticism by O'Keefe of a research report on nutritional anaemia amongst black preschool children of which they were co-authors. In their report they recommended, like others in the past, that maize meal must be fortified. O'Keefe indicated that such a step would not solve the problem of malnutrition, but that a more developmental approach would be needed. To this criticism, Metz and Van der Westhuizen responded that they agreed with O'Keefe. However, they also argued that fortification must be regarded as an urgent interim measure, because it is seldom possible to quickly increase the supply of food to populations at risk (Metz and Van der Westhuizen 1986:410) (O'Keefe 1986:845).

The greatest landmark, in the 1980s, in coming to grips with the problems of poverty and malnutrition, was the work started in 1980 and which culminated in the conference in 1984, known as the Second Carnegie Inquiry into Poverty and Development in Southern Africa. Awareness of the range and levels of issues which must be addressed to bring about fundamental changes in poverty and concomitant malnutrition, is clear from the report written by Wilson and Ramphele for the Inquiry. They summarise this in a chapter entitled "Tough Questions", as follows,

> *"(We) cannot conclude without emphasizing the crucial importance of seeing all facts, each cause, and every strategy as part of a wider interacting whole"* (1989:349).

Malnutrition and Poverty: A Brief Historical Perspective

Even a superficial perusal of historical studies on the micro or local level, indicate that despite the actions taken by small black farmers or peasants to take advantage of new technologies, the opening up of markets, recovery after periodical wars, droughts and stock diseases, a slow insidious and uneven process of impoverishment characterized the lives of black people in rural and urban areas, during the 20th Century. People's freedom of agency became severely restricted by

policies of neglect and deliberate discrimination emanating from the South African political-economy. For survival, people were forced to make choices which were rational on the short term, but unsustainable on the long term given the inexorable escalation of demographic pressures in confined spaces in a drought prone country with a political-economy based upon discrimination.

According to Wylie (1989), the broad outline of this process which transformed the wealth and health of people are similar everywhere where the industrial revolution took place in conjunction with colonialism. She characterized the process as one where land and work have become scarce and labour abundant, where once the opposite was the case. She added,

> *"Even where there is no land shortage, because cash increasingly regulates access to resources and people therefore distribute their goods less generously, subsistence farmers are becoming victims of "institutionalized poverty". What distinguishes the South African case is the effectiveness with which the law has excluded the surplus people from wealth which they and their ancestors helped create"* (1989:159).

Wylie – who does not imply that pre-colonial South Africa was a nutritional paradise - defines levels of health and nutritional fitness as a process related to the capacity of people to change through interaction with their environment. (1989:160). As I have very briefly tried to indicate, the colonial policies and policies instituted during the apartheid era, severely restricted the options of the majority of the black population in South Africa in their efforts to adapt to the environment created by the colonial political–economy. It is perhaps also of some significance that, in what is known as the First Carnegie Report (1932) on the poor-white problem, the commissioners were of the opinion that a main cause of poverty amongst poor whites was one of a lack of adaptation ("onvoldoende aanpassing") of the formerly isolated, simple, self-sufficient farming folk to the modern capitalist system. (Verslag 1932:viii) (my translation).

However, the structural position of whites was not the same as that of blacks. Although the poor whites lacked certain skills and formal education, the main purpose of the Report of 1932 was to make

recommendations to enhance ("empower" in current usage) their capabilities to adapt and compete successfully in the new system of production. The aim was to ultimately broaden their opportunities to make choices – to try and move them from the margins to the centre. Politically, they were at that stage already integrated into a democratic form of governance. For blacks in South Africa, on the other hand – the doors of choice were slammed shut, one after the other (cf. Mayer 1980:19). Blacks were literally and figuratively forced to stay on the margins, although there were some who chose not to be integrated into the white man's world (cf. Mayer 1980: 54).

Wylie succinctly describes the situation at one of these localities, around the middle of the 20th Century, as follows,

> *"By the early 1940s well over half the taxpayers of Pondoland were working elsewhere ... The line dividing those with flocks, who did not have to migrate, from those without land who did have to leave, was usually a political one. By reserving land for themselves...some Bunga councilors, chiefs and headman had become rentiers and even holders of large personal farms ... Traders helped to undermine the self-sufficiency of imizi (households). They did so by extending credit...a trader advanced credit in return for a man's promise to sign a mine contract should he default. Drought as well as land shortages had helped create this dependency which was never thereafter reversed. People were purchasing rather than growing a larger and larger proportion of their subsistence diet ....*
>
> *The debt spiral reinforced the tendency of smaller imizi to serve their own individual needs rather than to distribute food among neighbours. The dietary consequences of these social changes ...were dramatic. As they had to do .. earlier, the Mpondo reverted to a largely grain diet. The ideal of a milk-based diet became a myth or a memory for all but a privileged few"* (1989:183, 184).

As a general result of the discriminatory policies and intensification of internal differentiation on the local level, the contemporary situation with regard to access to agricultural resources in rural South Africa. was recently summarized as follows,

> *"About 26% of African rural households have access to a plot of land for crop cultivation, while 24% own livestock. Ownership of agricultural productive equipment is limited to 18% of rural African households"* (May 1998:46).

Taking the historical process and the above percentages into consideration, it is not surprising that from calculations based upon the final crop estimates for the 1999/2000 season, from what is currently called the emerging agricultural sector, black farmers produced only 4,5% of the total South African crop of white maize (South African Government: 2000). In 1994 it was estimated that about 20% of the white commercial farmers produced about 80% of the commercial agricultural products (Draft report 1994:13).

Despite the general low level of agricultural production, it is the 3rd most important means of livelihood tactic amongst blacks in rural areas, after remittance and wages from low-skilled work (May 1998:46). These sources of income are inadequate with the result that around 80% of rural blacks live below the poverty line and for the country as a whole, about 60% of black households fall in this income category (Draft Report 1994:13). According to the Draft Report of the Nutritional Committee to the Minister of Health, it was estimated that in 1990, about 2,3 million South Africans were nutritionally compromised, out of these 87% were black. The Report also indicates that although survey data are fragmented,

> *"(A)pproximately 16% of black children under 5 years of age are under weight for age and between 20% and 30% are stunted (under height for age) – an indication of chronic under-nutrition"* (1994:10).

Malnutrition: A Question of Values

As was indicated, during the 1980s and 1990s the realization was expressed that malnutrition was a multi-faceted societal problem. This was reiterated in the Draft Report as follows,

> *"Instead of the fragmented and food-based approach of the past, the Integrated Nutrition Programme proposed in this report focuses on the importance of linkages and co-ordination among a range of nutrition-relevant actions which*

> *will respond effectively at all levels to specific problems of malnutrition"* (1994:7) (cf. Glatthaar 1992: 1337-1338).

As a first guiding principle, the Draft Report indicates that nutrition is a basic human right (1994:9).

The broader perspectives on the problem of malnutrition seem to implicitly relate to the theoretical principles as set out by Rappaport (1997) in order to understand societal and environmental problems. His approach addresses, more specifically, problems in the United States. However, it can be used to understand the question of the long term sustainability of particular historical socio-cultural systems, created to accommodate the pervasive human problems of production, distribution of food, goods and services as well as of consumption (cf. Bodley 1997:424-446, for a useful summary of the complex issues relating to sustainability). Rappaport indicates that within these systems, what are generally known as problems, ills, disorders or "diseases" in society, must be understood from the perspective of an ecological logic, that stresses interdependence amongst qualitatively different things (1997:264). This perspective is based upon the assumptions that biological-ecological systems are historically, substantively, logically and from the perspective of value judgements, prior to or more fundamental than conventional socio-cultural creations (1997:266). Humans, from this point of view, can only live in terms of the meanings (convensions) they construct in a world without intrinsic meaning, but nevertheless, subject to natural law. He adds,

> *"Humans are trapped between meanings that may be misunderstandings and laws that may be mysteries".* (1997:287).

Arguing from this perspective, it is possible to view malnutrition and dire poverty as symptoms (substantive difficulties) of a more general disorder in social values (cf. Rappaport 1997:271). According to Rappaport, the general social disorders are related to the principle of contingency, i.e. the subordination of the fundamental and ultimate to the contingent and instrumental (1997:267). The elevation of the contingent to the fundamental is a process embedded in society because of the tendency of institutions, interest groups and individuals to gain differential power. This enables them to elevate their particular

values to predominate, which may lead to the narrowing of the range of conditions under which society can maintain itself (1997: 268).

Rappaport illustrates the elevation of the contingent to the fundamental with reference to the pre-eminence of certain powerful conventional or cultural voices. One of these is modern monetary logic, which is incapable of recognizing qualitative distinctions and subordinates all distinctions to the logic of commodity. This powerful aspect of our conventional or cultural logic, fragments ecosystems into agglomerations of more or less discrete "resources" (1997:264). This places the contingent over the fundamental, because the value attached to biological-ecological systems should take precedence over economic consideration (1997:266). However, Rappaport indicates that his criticism is not directed against modern economic analysis, but against its privileged position,

> *"As such, its mode of analysis, such as cost-benefit analysis based upon monetary metrics, are likely to be granted universal and ultimate bottom-line authority"* (1997:265).

The danger inherent in the all-powerful voice of monetary logic is that it decreases societal evolutionary flexibility, increases inequalities and degrades the environment (1997: 268). This relates to a remark by Bohannan, some time ago, with reference to the commodifying power of the use of all-purpose money. He wrote,

> *"Money is one of the shatteringly simplifying ideas of all time, and like other new and compelling ideas, it creates its own revolution"* (1959: 504).

Monetary logic and the cultural package of the market in which it is embedded, became the driving force behind the cultural logic inherited from Europe during the colonial era in South Africa. It not only grew strongerstrengthened through time, but was also distorted by racial logic. In this logic and its particular manifestations in the South African colonial political-economy and elsewhere, profit and private property can draw rigid boundaries between the have's and have not's. It creates a system in which the material benefits flow only to those allowed into the system and who are cognitively and affectively well

prepared to participate. But, even then, most of the benefits accrue only to a minority. Preparation to participate in this system requires from most people the successful negotiation of a vast array of institutionalized processes, from a relevant family environment, long term formal education, training in any one of the huge number of work specialties, adaptation to city environments, having parents who already benefited from the system and more.

The commercial and commodity aspects of monetary logic are both powerful and seductive. During the colonial era they embraced black people as workers and clients when deemed expedient, and were embraced by the majority of blacks through compulsion and choice. The dominant political side of the coin which was rejected by black people, was mostly driven by a jitteriness born mostly out of fear and white self-interest, that implied the ethnocentric sharing of some "civilizing" facets of white culture, preferably at a distance. It is also clear that during the greater part of the 20th Century, the power holders in South Africa were not really predisposed towards addressing the problem of malnutrition amongst blacks from an integrated or holistic perspective. However, even when technical solutions like fortification of staple foods or the breeding of protein enhanced maize were proposed as solutions, the possible benefits were argued within the context of monetary logic. In the case of QPM, after some perfunctory efforts at promoting the product, the voice of the market was decisive in its failure to fulfill its possible promise, except in the case of some commercial farmers who use it as animal fodder. Even the technological preferences of commercial millers, can be regarded as part of the same problem.

Since the 1960's the fortification of food and especially breakfast cereals, has also become a marketing device or competitive marketing gimmick, as is evident by a casual stroll past the food shelves of any supermarket. These "superfoods" are priced out of the reach of the poor. This was recently illustrated by an advertising feature in the Reader's Digest. Under the heading "Superbrands of all times", the following was said about one of these breakfast foods,

> *"Conceived by the brothers Hind in 1950, ProNutro was developed as a nutritious affordable food for the fight against malnutrition. The brand was re-launched as a functional health food in the mid-1960's and enjoyed increasing popularity and steady growth ever since"* (Anon. 2001).

I would surmise that "relaunched as a functional health food", actually refers to the fact that the product had become unprofitable as a food to fight malnutrition and was relaunched to fill a lucrative market niche.

Closely related to the powerful monetary or market discourse in the cultural logic of the industrial world, is the powerful voice of natural science – although it may be regarded as somewhat subordinate to the voice of the market – with its concomitant creation of technological innovations. It is a voice which was predominant in proposals to tackle the problem of malnutrition in the 20th Century South Africa. What strikes one in the perusal of the literature, is the refrain that a technical solution will be found, but that further study was necessary. It is of course possible that within the context of the time, the political powers of yore, could have used the discourse of natural science as a kind of rationalization to vindicate themselves in the eyes of the world to indicate that the problem is not being ignored, but a work in progress.

It is perhaps also relevant to note that the application of scientific / technological solutions, as manifested in the Green Revolution elsewhere in the world, can not be regarded as unreservedly successful in eradicating malnutrition and poverty (cf. Harris 1988:533-537) (Hayami and Otsuka 1994:19) (Korten 1990:12-13).

Some Conclusions

Maize, like other cereals, is an important food world wide. The role of maize as a staple food in the diet of millions of people must be evaluated within and not in isolation from, specific historical contexts. In this paper it is the context of the fairly recent termination of modern colonialism in South Africa. During this epoch, millions of people were marginalized and their economic well-being compromised within the system of production and distribution erected to accommodate the money and market logic. Furthermore, the benefits that may accrue to people within this system, the proverbial trickle down effect, literally stay at that level for the majority of black people in South Africa, because the market was skewed by the institutionalization of racial discrimination. The monetary logic of the market has now attained global dimensions, despite pockets of partial resistance (cf. Haines 2000: 54-56, Yang 2001: 447-509). Given the elaborate system erected around it, it seems virtually impossible to reason outside its confines, even with the growing realization that market driven technological innovations and fixes may have serious negative long term health and

environmental consequences (cf. Antle 1994:517-531) (Bodley 1997:424-446).

It has recently become clear that the South African Government is trying to address the problem of malnutrition at much more comprehensive level. Malnutrition is no longer seen merely as a health care and technical issue to be rectified by reluctantly throwing some money at the problem. Nevertheless, the addressing of the problem is still operationalized within the market system in which economic growth is stressed as perhaps the ultimate solution (May 1998:6). However, it is significant to note, in this regard, that at least one comparative study come to the conclusion that economic growth in a country is not a prerequisite for nutritional improvement. Improvement relates, in these instances, to putting policies in place to facilitate processes of community empowerment and the active participation of people in decision-making (Gillespie et al 1993:89).

Needed now are not only urgent efforts to alleviate symptoms, but the political will to create and implement that put people and their biological well-being first. But, these oft repeated phrases may well remain empty slogans in the long term. The greatest conundrum of our time – real "political dynamite"[4] is not the nutritional deficiency of a particular staple food or even the undeniable necessity of an integrated approach to solve the problem of malnutrition. The real challenge is to create social, political and economic systems that mediate between people and their environment, that responsibly promote the well-being of both, because their well-being is fundamentally and intrinsically inter-related.

NOTES

[1] Nutritional improvement or ennoblement, following sprouting and fermentation of cereals will not be discussed. The fermentation process in the preparation of food and drink is well known in the literature on the traditional food habits in South Africa (cf. Quin 1959: 162, 252, 260).

[2] Selection of breeding material by traditional plant cultivators is a well-known practice. Harlan refers in this regard to the amazing number of varieties of sorghum in Africa (1995:53-59).

[3] Recently the production of transgenetic plants in agricultural biotechnology was enthusiastically received. An example of work in progress is a bioengineered yellow rice that synthesizes the precursors of vitamin A, which is currently on trial (cf. Guerinot 2000: 241-243) (cf. also Presley 1994: 374-383).

[4] In a recent issue of a local newspaper, two items reflected political opposition to the global and local predatory face of the free market. One was a reference to the pending court case initiated by pharmaceutical firms, against the South African Government who wants to gain access to cheaper drugs, for the fight against Aids. The other was comment on government action taken against unscrupulous elements in the micro-lending industry (cf. Eastern Province Herald, 13 April 13, 2001: 2,4). For a brief summary of aspects of voluntary action on the global level in this regard, cf. Hackenberg (2000: 365-367). For a earlier overview of actions to be taken, cf. Korten (1990).

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