

Joernaal/ Journal

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Voedingswaarde en prys van heel en ontdopte lupienzaad



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Inleiding

Lupiëne is 'n belangrike wisselbougewas in die graanproduserende dele van die Wes-Kaap en ongeveer 75 000 ha lupiëne word jaarliks verbou. Lupiëne het egter sekere beperkinge vir gebruik in diëte van enkelmaagdiere, hoofsaaklik weens 'n hoë ruveselfraksie. Verder het sekere kultivars onaanvaarbare hoë vlakke van alkaloides wat toksies kan wees vir byvoorbeeld varke. Ander faktore wat genoem word wat die benutting van lupiëne deur enkelmaagdiere mag benadeel, is □-galaktosiedes, hoë vlakke van mangaan, hoë vlakke van nie-stysel polisaggarides en lae vlakke van lisien, swavelbevattende aminosure en triptofaan. Weens die tekortkominge van lupiëne as proteïenbron word dit gewoonlik teen beperkte vlakke in die diëte van, byvoorbeeld groeiende varke, gebruik. Normaalweg word insluitingsvlakke van tussen 10 en 20% alkaloidvry lupiëne vir groeiende varke aanbeveel. Die insluiting van hoë vlakke van lupienzaad in diëte van enkelmaagdiere gaan egter gewoonlik gepaard met 'n afname in inname, groei en voeromset.

Die meeste navorsers kom tot die gevolgtrekking dat die verlaagde produksiepotensiaal van lupienzaad vir enkelmaagdiere aan die relatief hoë veselinhoud toegeskryf kan word. Dit het gelei tot die ondersoek na die moontlikheid om lupiëne te ontdop, aangesien die grootste persentasie vesel in die dop aanwesig is. Oor die algemeen blyk dit dat ontdopte lupiëne beter benutbaar deur enkelmaagdiere is as lupiëne met doppe. Oorsese navorsing bevestig ook hierdie resultate volgens die bevindinge dat groeiende varke betekenisvol beter resultate getoon het met ontdopte as met gebreekte lupiëne.

Chemiese samestelling

Teneinde die chemiese samestelling van heel en ontdopte lupiëne sowel as die chemiese samestelling van die doppe van lupiëne te bepaal is vier plaaslik beskikbare kultivars in die Elsenburg Dierevoeding Laboratorium met die hand ontdop. Die resultate word in Tabel 1 weergegee. Dit blyk uit hierdie gegewens dat die dopfraksie ongeveer 25% van *Lupinus angustifolius* (smalblaar-kultivars) en 17 tot 20% by *Lupinus albus* (breëblaar-kultivars) uitmaak. In beide gevalle word die proteïeninhoud verhoog (16 - 18% verhoging by *L. albus*-kultivars en 27 - 30% verhoging by *L. angustifolius*-kultivars) en ruveselfraksies verlaag het (60 - 80%). Fernández & Batterham (1995) rapporteer soortgelyk dat ontdopte lupienzaad (kerne) 'n hoër proteïen- (40.5% vs. 31.1%) en lisieninhoud (2.0% vs. 1.6%) het. Die verteerbare energie-inhoud is verhoog van 13.1 MJ/kg tot 16.3 MJ/kg en die ruvesel verlaag van 17.2% tot 5.1% in hulle studies. Die chemiese en aminosuursamestelling van lupienzaad, lupienkerne en lupiendoppe van die kultivar Gungurro (*L. angustifolius*) vanuit die studie van Fernández & Batterham (1995) word saam met die samestelling van sojaboonoliekoekmeel in Tabel 2 weergegee.

Prysbepaling

Alhoewel direkte prysbepaling van grondstowwe moeilik is, aangesien elke grondstof sekere inherente eienskappe het, kan 'n moontlike aanduiding van prys op grond van chemiese en aminosuur analise wel tot 'n mate beraam word met behulp van minimumkoste-rekenaarprogramme. Op grond van vergelyking van die voedingswaarde van heel soetlupiëne sowel as lupienkerne (beide gebaseer op *L. angustifolius* cv. Eureka) met vismeel en sojaboonoliekoekmeel blyk dit dat heel lupiëne (soet

Tabel 1. Die chemiese samestelling van heel en ontdopte lupienzaad van vier verskillende kultivars†

Samestelling	<i>L. albus</i> cv. Hamburg			<i>L. albus</i> cv. Kiev			<i>L. angustifolius</i> cv. Eureka			<i>L. angustifolius</i> cv. Stevens		
	Heel	Dop	Kern	Heel	Dop	Kern	Heel	Dop	Kern	Heel	Dop	Kern
Fisiese samestelling, %	100	19.5	80.5	100	16.8	83.2	100	25.5	74.5	100	26.5	73.5
Droë materiaal, %	91.1	91.3	91.6	90.5	89.4	90.2	91.5	89.2	90.4	91.1	91.3	91.3
As, %	3.2	2.6	3.6	3.2	2.5	3.1	2.9	2.3	3.0	2.8	3.0	2.8
Ruproteïen, %	37.0	5.5	43.6	35.7	3.6	41.6	30.7	5.1	39.0	29.3	4.3	38.5
Vet, %	9.8	1.3	10.5	8.4	1.0	12.3	4.2	1.2	5.8	4.4	1.0	5.8
VOM, %	85.5	71.9	88.3	87.2	69.6	91.5	92.2	81.0	93.5	91.6	73.5	93.5
TVV, % ††	101.3	72.9	105.1	99.5	71.0	111.7	94.1	80.1	98.7	94.0	94.2	98.7
Ruvesel, %	12.9	50.2	3.9	13.4	50.7	4.9	16.7	49.0	2.8	16.5	50.0	3.4
NBV, %	18.0	72.4	4.5	19.2	73.9	4.0	24.5	69.8	4.9	24.9	71.3	4.7
SBV, %	15.1	59.6	3.9	16.3	61.4	5.2	21.4	56.9	6.4	22.0	58.8	4.9
Kalsium, %	0.2	0.6	0.2	0.2	0.6	0.2	0.3	0.7	0.2	0.3	0.8	0.2
Fosfaat, %	0.3	0.1	0.5	0.3	0.1	0.4	0.3	0.1	0.5	0.4	0.1	0.5

VOM in vitro verteerbare organiese materiaal; NBV - Neutraalbestande vesel; SBV - Suurbestande vesel;

TVV Totaal verteerbare voedingstowwe.

† Alle waardes op 'n natuurlike vogbasis.

†† TVV is aangepas vir hoë olie-inhoud deur 2% af te trek by die vetpersentasie (algemene vetinhoud van graan), die res van die vet te vermenigvuldig met 2.25 (TVV van vet in verhouding met graanstysel) en by te tel by die TVV soos bereken vanaf die in vitro verteerbare organiese materiaal.

Tabel 2. Die chemiese en aminosuursamestelling van lupiensaad, -kerne en -doppe (*L. angustifolius* cv. Gungurro) volgens Fernández & Batterham (1995)†

Samestelling (%)	Lupiensaad	Lupienkerne	Lupiendoppe	Sojaboon-oliekoekmeel
Droë materiaal	92	93	94	89
Ruproteïen	31.1	40.5	5.6	42.8
Ruvet	3.6	7.6	1.5	0.9
Ruvesel	17.2	5.1	61.9	6.1
NBV	31.3	11.0	74.7	15.2
Alkaloïdes	0.07	0.13	0.01	0
Essensiële aminosure				
Lisien	1.6	2.0	0.4	2.8
Metionien	0.16	0.21	0.04	0.53
Sisteïen	0.25	0.31	0.03	0.53
Valien	1.3	1.7	0.29	2.2
Treonien	1.2	1.5	0.24	1.8
Histidien	0.8	1.1	0.13	1.1
Isoleusien	1.4	1.9	0.25	2.2
Leusien	2.2	2.9	0.40	3.5
Tirosien	1.2	1.6	0.18	1.6
Fenielalanien	1.3	1.7	0.25	2.2

† Lugdroë basis

†† NBV - Neutraalbestande vesel

smalblaar tipes) aangekoop kan word teen 42% van die prys van vismeel en teen 60% van die prys van sojaboonoliekoekmeel. Met ontdopping sal die prys kan styg tot 54% van die prys van vismeel en 77% van die prys van sojaboonoliekoekmeel.

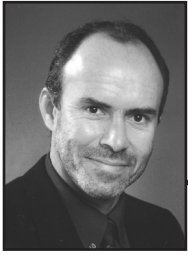
Gevolgtrekkings

Ontdopping kan die waarde/prys van lupiene met ongeveer 30% verhoog. Indien lupiene ontdop is, kan dit ook teen hoër vlakke in die diëte van enkelmaagdiere ingesluit word. Dit is egter noodsaaklik dat slegs alkaloïedvrye kultivars in die diëte van enkelmaagdiere gebruik word. Vir herkouende diere is ontdopping van lupiene onnodig. Lupiene kan gemaal of gerol aan beeste gegee word, terwyl skape heel lupiene baie goed benut.

Verwysings

Op aanvraag beskikbaar.

The socio-economic dimension of agritourism



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'If we engage our destiny, we are yielding to the design of the universe, which is speaking through the design of our own person.'
(Jaworski, 1996)

'If we have truly committed to follow our dream, there exists beyond ourselves and our conscious will a powerful force that helps us along the way and nurtures our growth and transformation.'
(Jaworski, 1996)

Introduction

Agritourism has been identified as one of the options available to farming communities (Nowers and De Jager, 2002), and not only farmers alone, in order to stabilize and in fact increase their net income of their businesses and improve the quality of life at all levels. The addition of more tourists to a region does not only impact on the visiting farm alone, but also on the broader community and local amenities as well. This will necessitate the consideration of changes in management plans and even adapted value systems. According to Senge (1990), the essence of a learning organisation, in this case the management of the farming business involves not only the development of new capacities, but also fundamental shifts of mind, individually and collectively. In many aspects this requires a fresh look at present infrastructure and the needs of the tourists, as well as an intra-reflection on own attitudes towards this 'new' social elements that may change the social dynamics of a rural community.

The purpose of this article however is to investigate the social dynamics of the social elements within a farm which is involved with agritourism as an economic enterprise. An attempt will be made to devise a basic template to measure 'quality of life' at farm level. In the process the author will reflect on some sociological principles and issues and will endeavour to provide more insight into the 'Quality of Life' issue and its application at farm level.

2 Inviting sociological thinking into the field of economics

Economic sociology is staging a comeback after years of relative obscurity (Guillén, Collins, England and Meyer, 2002). From literature it becomes evident that the issues explored by modern scholars mirror the original concerns of the sociology discipline which emerged in the first place as a science geared towards providing an institutionally informed and culturally rich understanding of economic life. Classic founders of sociological thinking like Karl Marx, Emile Durkheim, Max Weber and George Simmel (Guillén et al, 2002) planted the seeds for the systematic study of social classes, gender, race, complex organisations, work and occupations, economic development and culture as part of a unified sociological approach to economic life. Subsequent theoretical developments led scholars away from this originally unified approach. In the 1930's Talcott Parsons (Guillén et al, 2002) reinterpreted the classical heritage of economic sociology thereby clearly differentiating between economics and sociology. Dobbin (2004) viewed sociologists as being inductive in nature, deriving theories of social behavior by observing behavior, whereas economists were deductive, deriving theories of economic behavior from the axiom that self-interest drives individual behavior. This development discouraged sociologists from participating in the economics-sociological dialogue.

However during the 1960's the sociological studies of economic phenomena relating to production issues such as marketing, thrived, especially in the sub fields of organisations and of work and occupations. Over the years, however, organisational sub fields drifted apart

from sociology both in terms of theoretical concerns and academic organisation. Theories regarding resource dependence, transaction-cost economics and population ecology, established few connections with other sociological areas. The new organisational sociology became known as organisational theory, and organisational sociologists increasingly moved from sociology departments to business schools (Gans, 1990). In addition to the study of production issues inside organisations, sociologists studied work, labor and occupations from the point of social stratification.

The sociology of work and occupations developed fairly independent of organisational theory and social stratification, notwithstanding a call for a more integrated approach by scholars. Meanwhile the sociology of development became another specialty that devoted systematic attention to the study of economic processes, especially those involved with industrialization and economic growth (Guillén et al, 2002). However sociologists have traditionally devoted less attention to consumption and leisure although studies have appeared as far back as the early twentieth century.

Renewed interest in economic sociology as a research area in its own right did not develop until the mid-1980's despite attempts to stimulate interest in this field during the 1970's and early 1980's. Economic sociology is "...the study of the social organisation of economic phenomena, including those related to production, trade, leisure and consumption" (Granovetter, 1992; Guillén et al, 2002). These phenomena, which are not necessarily mediated by monetary payments, can be observed at various levels of analysis – namely the individual, the group, the household, the organisation, the network, the market, the industry, the country and the world system. Although economic sociologists differ in their theoretical and empirical techniques, they share an interest in both processes and outcomes, and in inequality as well as efficiency. In particular, economic sociology seeks to understand economic phenomena in their social and cultural contexts, without falling into the trap of three fallacies common to economic analysis. Firstly, that the social is a realm separate from the economic as economic sociologists argue that all economic activity is socially grounded and enabled (Swedberg and Granovetter, 1992) and that no economic phenomenon can be assessed without the shared understandings, institutional structures, symbols and networks of inter-actor relationships that concretize it and give it form. They, economic sociologists, also reject the notion that the social or cultural dimensions of society 'interfere' with the smooth functioning of the economy.

The second fallacy according to economic sociologists is the belief that individuals make conscious calculations about how to maximize utility, and that the preferences that determine their utility functions are exogenous to the models of interest. Drawing from a variety of anthropological, ethnographic, social-psychological, psychoanalytic, linguistic and sociological research, economic sociologists see both preferences and actions as fundamentally connected to and affected by cognitive biases, limited powers of reasoning, non-conscious and ambivalent feelings, role expectations, norms, and cultural frames, schemata, classifications, and myths (Guillén et al, 2002). Hence both utility maximization and the isolation of strictly economic variables are unacceptable to economic sociologists, since such reductionism hinders the understanding of economic phenomena.

A final important difference is that economic sociologists reject the idea that the aggregation of individual-level behaviour is straight-forward and unproblematic. The social argument is that all action – whether driven by interests, power or trust – results in outcomes that are shaped not only by the individual actor's motives, but also by larger social, cultural and institutional structures (Granovetter, 2002).

Economic sociologists add value to the traditional economic agenda in

the sense that fresh theoretical insights about economic phenomena are provided that represent either complementary or competing explanations to those proposed by the traditional rational-choice, utility-driven economic models. The following are an illustrative list of sociological contributions to key debates about economic action (Guillén et al, 2002):

Culture – Sociologists emphasize that economic action cannot proceed without shared understandings about appropriate behavior in a given social setting. Cultural understandings lie at the core of economic action because they provide stability and meaning which help the actors to make sense of the situation, develop strategies for action and adjust their expectations and behavior as they interact with others (Hamilton and Biggart, 1988). Economic sociologists invoke values and norms, network structures, the state, and ideologies as factors creating shared understandings amongst participants in the various arenas in which economic activity takes place. This includes markets, groups, organisations and households. It is argued that the resultant social structure helps participants search for a niche in which they develop an identity and adopt a certain set of roles;

Networks and social capital – There exist an argument that economic action can be facilitated or hindered by the actor's position in a network of relationships (Guillén et al, 2002). Many economic sociologists invoke the concept of social capital to explain why some actors are more successful than others at mobilizing resources or attaining their goals (Burt, 1982; Coleman, 1990; Burt 1992). They have also explored the interdependent mechanism of this construct, pointing out that one actors social capital may be another's social exclusion – an argument that brings power, interest, and discrimination into the analysis of economic action;

Trust – Empirical evidence has shown that economic action is often not based on a self-interested assessment of incentives, as argued by economists. It is rather based on trust, which is historically developed and culturally specific, although not exclusive to any one culture. Economic sociologists point out that trust helps to explain the observed order, stability and continuity in social life that occurs because of genuine emotional caring or norms of obligation that binds actors in spite of their incentives (Granovetter, 2002); and

Effort and motivation – Economic sociologists are keen to point out several key factors that shape commitment and effort at work apart from the traditionally considered structure of material incentives. It has been pointed out that blind obedience driven by economic incentives is not sufficient for organisations to successfully complete their work. Culture, ideology, ethics at work and effort guide responses to unforeseen circumstances and opportunities. More recently greater emphasis are placed on the complexity of human motivations to work productively (Guillén et al, 2002).

In summary, economic sociologists have expanded the variables considered by economists and led to the recognition of the complexity and interdependence of social and economic elements. Scholars in this emerging field have called for more systematic attention to economic activity not done for money alone but to incorporate social issues within the economic analysis of activities. This new thinking in sociological and economist circles thereby encourage and allow the author to explore the concept of life, and more specifically the 'quality of life' concept within the arena of agriculture at micro-level.

3 The social aspect of 'life'

This study argues that agritourism involves new actors, the agritourist, onto a farm which may disturb the traditional quality of life of all people directly but also indirectly involved. Coming into contact with foreign people with other cultures and needs will necessitate certain adaptations in thinking which ultimately will impact on all forms of life on the farm itself. This will include changes in the lives of the farm manager/owner and his/her family, the employees and even the natural and ecological environment. Visitors want to see pristine habitats, well cared for livestock enterprises, neat buildings another infrastructure, motivated and happy employees as well as a successful and vibrant farming business. These needs center on the quality of life of all actors involved within the farming business, biotic as well as abiotic.

Lovelock (1979) in his thought-provoking book "Gaia – A new look at life on earth", asked the following question: 'What is life, and how should it be recognised?' He (Lovelock, 1979) reasoned that it should involve an entropy reduction, since this must be a general characteristic of all forms of life. However this view was regarded by Fourie, Joubert and Loader (1990) as being too mechanistic in nature. It was expected to find in literature a comprehensive definition of life as a physical process

on which one could base the design of life-detection experiments, but it seems little had been written about the nature of life itself. Apparently mankind's automatic recognition system appears it have paralyzed his capacity for conscious thought about a definition of life.

The difficulty of defining what life is and the vast amount of thought that has gone into Western Philosophy of life cannot be bypassed in an approach based simply on the concept of life, resulting in the question of how should life be defined (Fourie et al, 1990). However, during the 1970's a few scientists have tried to define life (Lovelock, 1979). Bernal (1988), Schroedinger (1996) and Wigner (in Lovelock, 1979) all came to the same general conclusion that life is a member of the class of phenomena which are open or continuous systems able to decrease their internal entropy at the expense of substances or free energy taken in from the environment and subsequently rejected in a degraded form. This definition is not only difficult to grasp but is far too general to apply to the specific detection of life. A rough paraphrase might be that life is one of those processes, which are found whenever there is an abundant flow of energy. It is characterized by a tendency to shape or form itself as it consumes, but to do so it must always excrete low-grade products to the surroundings. Perhaps the more relevant and interesting definition is that given by Fourie, Joubert and Loader (1990):

"Life is a teleological process of increasingly complex relationships noted in the abiotic aspect of reality, developing through the stadia of spontaneous and dynamic regeneration by species and culminating in consciousness:

Yet, even if too broad and vague, the above classification of life at least points in the right direction. It also suggests that life-like processes require a flux of energy above some minimal value in order to get going and keep going. Fourie, Joubert and Loader (1990) argue that life is a focal point in the human environment (this include his natural, political, social and economic environment) and that inevitably human actions are subconsciously based on this concept. They (Fourie et al, 1990) reason that the concept of life opens many relevant perspectives and that timely reflection on this concept will awaken the necessary reflection, awareness, action and responsibility to the benefit of the environment in its broadest sense. In order to survive, all forms of life should be vibrant in nature suggesting the inherent ability to be able to adapt to changing environments.

Lauer (1989) asks the question 'what is this quality of life that plays so prominent a role in the well-being of human society and social problems?' He (Lauer, 1989) suggests that it ranges from safety standards for children's toys to government subsidies for the arts. The desire to 'live deep', to maximize the quality of human life, is reflected in a number of studies. Ikerd (2002) describes quality of life as "... a product of positive relationships, from caring about other people and sharing with other people, from living with a sense of purpose and meaning, from living in harmony with a higher order of things". It seems thus that meeting individual needs is an important dimension of quality of life, but it should be balanced with the meeting of interpersonal and spiritual needs. Quality of life is improved when social and ecological dimensions are balanced with the economic dimensions of human lives (Ikerd, 2002). Sustainability, ultimately, then is all about improving the quality of life of people.

Lauer (1989) reports that the Midwest Research Institute evaluated all USA States in terms of equality, agriculture, technology, education, and health and welfare. Each state was scored on each characteristic and then ranked according to the overall 'quality of life' it offered. This concept of quality of life included things such as economic opportunity, health facilities, and environments conducive to good health, access to recreational and cultural activities, and minimal crime.

Campbell (1981) states that concern with and studies of the quality of life predate the 1970's. It seems there is general consensus to the things that influence the quality of life and the aspects people define as being important to the quality of their lives. Barnaby (1988) argues that everything depends on how quality of life are defined and measured. Life expectancy and infant mortality rates are common indicators with nutrition, sanitation, and social caring being at least just as important. Another measure is 'satisfaction of need' (Barnaby, 1988) with emphasis on consumer needs and thus the pursuit of 'progress'. True human needs are however deeper – physical well-being and a sustainable lifestyle, the chance to express one's human potential and contribute to society, to live, to love and share in a flourishing environment. It follows that people need:

- Good economic conditions (job opportunities and financial security);
- Good health and access to good health-care facilities;
- Opportunity for good education;
- Facilities and opportunities for participation in cultural activities
- Live and work in areas where there is minimal crime;

- Seek respect from other people;
- Want to respect themselves and have a sense of their own worth; and
- Want to live without fear and with reasonable freedom from stress.

This implies that quality of life is diminished when individuals lack the tools necessary to participate effectively in political processes, to achieve some measure of success in work or a career, or to develop his/her potential to its fullest. It follows that education is important to achieving improved quality of life. Another identified aspect that impacts on the quality of life of people is the presence of family problems which leads to emotional stress for the individuals. The age structure is another aspect that needs attention as it seems that the older people get, the more important meaningful relationships are (Doyle and Forehand, 1984). Clearly social interaction is important to the quality of life of the elderly.

Alcohol misuse also impacts on the quality of life of people as it may lead to family stress problems (interpersonal problems), health problems, financial problems, psychological problems. Crime is another factor that impacts on the above social phenomena as it leads to personal trauma. Crime may restrict the individual's movement in various ways and leads to distrust in societies, the lowering of morale and creating widespread social disorganisation. Drug abuse contradicts physical well-being as narcotic addiction ultimately leads to both physical and psychological deterioration. Environmental problems such as the over-crowding of people in homes, poor literacy levels, diseases such as HIV/Aids, poor access to recreational areas, pollution, high inflation, hunger, overgrazed land, low and unsustainable income, urbanization, deforestation, conflict between racial groups, inadequate health services, inadequate access to clean water, unemployment, energy shortages, and threats to individual freedom, all impact negatively on the quality of lives of people and groups.

Improved education lead to improved personal opportunities. Personal prejudices such as prejudices against homosexual people may lead to friction and impairments on personal lives. Prejudices against certain racial as well as sexual groups may affect the right to vote, intimidation amongst groups, poor access to resources such as land and education, and freedom of movement and economic empowerment. Poverty aggravates other negative factors affecting the quality of life as it intensifies emotional and physical problems and limits meaningless relationships. Equal opportunities to jobs, health and education are greatly diminished and lead to discontent and despair. Poverty may also lead to the migration of younger people to external areas thereby leading to older groups remaining in rural areas, as well as a positive impact in prostitution. Negative results may be the rape of women and children. According to Lauer (1989) meaningful work contributes to a higher quality of life as both emotional and spiritual benefits may accrue. This is especially true the older a person gets, as interactions with people become ore important. However work-related stress may lead to the opposite in that health problems may occur.

The quality of life concept suggests harmony with the immediate environment if a positive level is to be realized. This then necessitates a closer look at environmental and even ecological issues as these refer to a deep awareness of the individual and linked components of a system as well as taking responsibility for the final outcome. These aspects lead to the fact that farms should be regarded as open systems as political, social, economical and ecological aspects seldom know boundaries.

According to Devall (1985) organisations which work only in a conventional way on political and economic issues will more or less unavoidably neglect the deepest philosophical-spiritual issues. The new democratic dispensation makes provision for this, as the issue of black economic empowerment both vertically and horizontally at all farm levels, are accepted by the organized agricultural sector. Indeed such actions implies '...personal, caring, individual action in the context of small groups' (Devall, 1985). Catton and Dunlap (1980) state that human characteristics are socially induced rather than inborn and this sense they can be socially altered and inconvenient differences can be eliminated. This then alludes to the fact that given certain incentives, human behavior and therefore management practices can be altered to the benefit of improved managerial practices and ultimately an improvement in the quality of life of employees.

This study argues that the manager of a farm that employs agritourism as an enterprise will ultimately recognise the need for improving the quality of life of his resources. In order to adhere to the expectations of the tourist he will firstly be forced to improve the life expectancy and neatness of his infrastructure (gardens, buildings, orchards, vineyards, livestock infrastructure), machinery like tractors and implements, and the quality of life of his employees, and secondly this change in managerial thinking will become a spontaneous and in-born to successors. Agritourists want to see neat and clean buildings and gardens, well-cared for vehicles

and implements, pristine natural environments and humanely treated farm animals, and well motivated and knowledgeable farm workers with clean and properly serviced gardens and housing (Nowers and De Jager, 2002). These actions result in a more sensitivity towards social and environmental aspects within a farming business to the benefit of the often perceived traditional image of modern agriculture, which is unsustainable, specifically in relation towards its management of social and natural resources.

In contrast to the abovementioned argument of an embedded sensitivity towards social and ecological systems, the modern narrow emphasis upon efficiency (Devall, 1985) tend to drive people away from the larger issues of environmental ethics and individual responsibility for the consequences of their actions. Some environmental scientists such as Devall (1985) argue that technological societies not only alienates humans from their environment but also alienates humans from themselves and from each other.

Devall (1985) devised a term 'deep ecology' attempting to describe a more spiritual approach to man's relationship with his social and ecological environment. Deep ecology attempts to articulate a comprehensive religious and philosophical view of the world and its components, with mankind's values and ethics receiving particular attention. This concept goes beyond the presupposition that the modern western man employs an isolated ego striving primarily for hedonistic gratification or for him employing a narrow sense of individual salvation in this life or the next.

Spiritual growth begins when man cease to understand or see himself as isolated and narrow with a competing ego and begin to identify with other humans. The deep ecology sense of self requires a further maturity and growth, an identification which goes beyond humanity to include the nonhuman world. Table 1 indicates the different views between deep ecology and a dominant worldview:

Table 1: Summary of the contrast between the dominant worldview and deep ecology (Devall, 1985)

Dominant worldview	Deep ecology
Dominance over nature	Harmony with nature
Natural environment as resource for humans	All nature has intrinsic value/ biospecies equality
Material/economic growth for growing human population	Elegantly simple material needs (material goals serving the larger goal of self-realization)
Belief in ample resource reserves	Earth 'supplies' limited
High technological progress and solutions	Appropriate technology: non-dominating science
Consumerism	Doing with enough/recycling
National/centralized community	Minority tradition/bioregion

The basic intuition suggests that all organisms and entities in the ecosphere as parts of a related whole are equal in intrinsic value. Although in the greater process of life, all species use each other for food, shelter, etc. Mutual predation is a basic fact of life, but it should be acknowledges that biocentric equality is intimately related to the all-inclusive 'self realization' in the sense that if one component of nature is harmed, ultimately it may be to the detriment of life as such. This insight requires of man to respect all human and non-human life. The practical implications of the deep ecology concept implies that man should live with minimum rather than maximum impact on other species – 'simple in means, rich in ends' (Devall, 1985).

A further analysis of the biocentric norm includes the realization that individual humans as well as communities of humans, have vital needs which go beyond basics such as food, water, and shelter to include love, play, creative expression, intimate relationships with a particular landscape and other humans, as well as the vital need for spiritual growth. So, what then is the rationale of deep ecology? Devall (1985) list its basic principles as:

- The well-being and flourishing of human and nonhuman Life on Earth have value in themselves. These values are independent of the usefulness of the nonhuman world for human purposes;
- Richness and diversity of life forms contribute to the realization of these values and are also values in themselves;
- Humans have no right to reduce this richness and diversity except to satisfy vital needs;
- The flourishing of human life and cultures is compatible with a substantial decrease of the human population. The flourishing of nonhuman life requires such a decrease;
- Present human interference with the nonhuman world is excessive, and the situation is rapidly worsening;
- Policies must therefore be changed. These policies affect

basic economic, technological and ideological structures. The resulting state of affairs will be deeply different from the present;

The ideological change is mainly that of appreciating life quality rather than adhering to an increasingly higher standard of living. There will be profound awareness of the difference between big and great; and

Those who subscribe to the foregoing points have an obligation directly or indirectly to try to implement the necessary changes.”

Indeed, Devall (1985) concludes that if “...all governments set specific population targets as public policy to help alleviate poverty and advance the quality of life, the current situation of poverty, joblessness and resulting crime could be improved.” This statement alludes to government facilitating a tool to not only encourage the improvement of the quality of life of people, but also a mechanism to measure the success rates of policy measures induced to address this issue. The following section will attempt to identify and group such a tool to evaluate the standard of the quality of life of people.

4 Measuring Quality of Life

It follows from the above that sustainable agriculture has three fundamental pillars which should be sufficiently adhered to in order to improve the sustainability and quality of all life within an environment – in this case life on farms. From the literature and from personal experiences the following structure is proposed:

Economical indicators

Net Farm Profit per unit
Market value of land
Intra-diversification
Vertical diversification (value-adding)
External income sources (inter-diversification)
Strategic plan
Environmental audit
BEE plan
Economic and financial records
Volume of fuel usage
Number of hectares per full-time employee

Ecological indicators

Access to clean water (taps in house)
Access to energy (wood, gas, electricity)
Ablution facilities (long drops, flush in house, guest toilet)
Employees have own gardens (neatness, diversity, all-year)
Quality of grazing (grazing capacity)
Number of rooms
Waste management
Deforestation
Quality of water sources
Accreditation of enterprises (EUREPGAP, etc.)
Annual soil samples
Annual water samples
Fire breaks
Proper and safe chemical storage
Free ranging livestock
Environmental audit

Social indicators

Turnover of personnel
Remuneration level
Access to bank account
Number of days leave
Personal loans per worker
Disciplinary incidents per annum
Stability of income flow
Days absent from work
Average age of personnel
Family size
Number of people staying on farm
Changes in training levels (literacy levels)
Access to television (in own home; M-net, DSTv)
Access to telephone (in home, cellular phone)
Access to transport (own transport)
Insurance on assets
Personal insurance
Distance traveled when on leave
Access to recreational areas
Number of dependants per worker (family size)
Health care

Security
Self-respect
Stress levels
Crime incidents per year
Exposure to technology
Contact with visitors (guiding)
Threats to individual freedom (sexual orientation)
Political freedom to express
Conflict amongst racial groups
Levels of social interaction
Levels of substance abuse
Diversity in diet
Involvement in agricultural plans/farm management
Involvement in BEE

The above indicators should be workshopped to add and delete functional and not applicable indicators, to define and score each indicator, and to weigh them in order to get an a weighed final score of the quality of life on a farm. This list should in addition be stream-lined to be able to measure the quality of life of employees alone, allowing comparisons of performance between years and between farms of both similar and different nature (enterprises) and between regions.

5 Summary and conclusions

Exploring some literature on new economic sociology made an argument for the inclusion for social thinking and consideration within economic analysis. This lead to the identification of the ‘quality of life’ concept as tool to measure the social impact an enterprise such as agritourism may have on actors involved within a farming context. This article identified both from literature and personal experiences some economic, ecological and social indicators to measure quality of life. However these indicators should be refined and a scoring sheet should be developed in order to make it useful for evaluating the performances of farms.

Bibliography

1. BARBABY, F. [editor] (1988) *The Gaia peace atlas – survival into the third millennium*. Pan Books, London
2. BERNAL, M. (1988). Martha E. Bernal. In A. N. O’Connell, & F. N. Russo. (Eds.), *Models of achievement: Eminent women in psychology*
3. BURT, RS (1982) *Toward a Structural Theory of Action: Network Models of Social Structure*. New York: Academic Press
4. BURT, RS (1992) *Structural Holes: The Social Structure of Competition*. Cambridge, Mass.: Harvard University Press
5. CATTON, W. & DUNLAP, R. (1980) New ecological paradigm for post-exuberant sociology. *American Behavioural Scientist* 24, September 1980
6. COLEMAN, JS (1990) *Foundations of Social Theory*. Cambridge, Mass.: Belknap Press of Harvard University Press
7. DEVAL, B. (1985) *Deep Ecology*. Gibbs m. Smith, Inc. Utah
8. DOBBIN, F (2004) The Sociological View of the Economy. In *The New Economic Sociology: A Reader*. Edited by Frank Dobbin. Princeton University Press, Princeton and Oxford
9. FOURIE, J; JOUBERT, SCJ and LOADER, JA (1990) *Environmental Education – an Approach based on the Concept of Life*. Koedoe Vol 33/1
10. GANS, HJ (1990) *Sociology in America*. Newbury Park, California, Sage Publications
11. GRANOVETTER, M (2002) A Theoretical Agenda for Economic Sociology. In *The New Economic Sociology: Developments in an Emerging Field*. Edited by Guillén, MF; Collins, R; England, P and Meyer, M (2002) Russel Sage Foundation, New York.
12. GUILLÉN, MF; COLLINS, R; ENGLAND, P and MEYER, M (2002) The Revival of Economic Sociology. In *The New Economic Sociology: Developments in an Emerging Field*. Edited by Guillén, MF; Collins, R; England, P and Meyer, M (2002) Russel Sage Foundation, New York.
13. HAMILTON, GG and BIGGART, NW (1988) Market, Culture and Authority: A Comparative Analysis of Management and Organisation in the Far East. *American Journal of Sociology* Vol 94
14. IKERD, J. (2002) *Program in Agrarian Studies Colloquium*, Yale university, New Haven
15. JAWORSKI, J. (1996) *Synchronicity – The inner path of leadership*. Berrett-Koehler Publishers, San Francisco
16. LAUER, RH (1989) *Social problems and the quality of life*. Wm. C. Brown Publishers, Dubuque, Iowa
17. LOVELOCK, J.E. (1979) *A new look at life on earth*. Oxford University Press, New York
18. NOWERS, RJ & DE JAGER, JL (2002) Agrotourisme as Bedryf in die Wes-Kaap met spesifieke verwysing na die Tuinroete van die Suid-Kaap *Elsenburg Joernaal* 2002
19. SENGE, P (1990) *The fifth discipline*. Doubleday: New York
20. SCHROEDINGER, E (1996) *What is Life*. Cambridge University Press
21. SWEDBERG, R AND GRANOVETTER, M (1992) Introduction. In *The Sociology of Economic Life*, edited by Mark Granovetter and Richard Swedberg. Boulder, Colorado: Westview.

Natuurlike horisontale gene-oordrag en antibiotikaweerstandbiedendheid



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Abstract

The media is full of stories about genetically modified organisms and the possible dangers associated therewith. If one tries to gain scientific information on the subject, it becomes clear that a far greater danger lies in antibiotic resistance, a scary reality. This paper reviews horizontal gene transfer in nature and its role in antibiotic resistance. It also looks at possible reasons why this phenomenon has escalated in the last few decades.

Inleiding

Die internet, dagblaaie, landbouydskrifte en watter ander vorm van media denkbaar, hou hulself dikwels besig met die onderwerp van genetiese manipulasie, kortweg GM. Die algemene indruk wat geskep word, is dat die oordrag van genetiese materiaal van een organisme na 'n volgende uiters kunsmatig en onnatuurlik is. Sou 'n persoon egter 'n wetenskaplike studie van die onderwerp maak, word daar gou agtergekom dat dit 'n baie algemene tendens is wat daagliks in die natuur, sonder direkte inmenging van die mens, plaasvind. Hierdie artikel poog om 'n oorsig te gee van die natuurlike prosesse waar genetiese materiaal tussen organismes uitgeruil word, die ontwikkeling van antibiotikaweerstand en hoe landboupraktike moontlik hierdie weerstand in die hand werk.

Gene-oordrag in die natuur

Mikro-organismes het vanweë hul grootte, 'n beperkte aantal gene. Dit gebeur dus dat sekere genetiese inligting, vanweë die verandering van die omgewing, oorbodig raak. Mikro-organismes is in staat om van hierdie stukkie gene ontslae te raak (Ochman & Moran, 2001). Stukkies DNA kom ook vry wanneer organismes sellise ondergaan. Hierdie DNA kan soms vir weke en selfs maande "lewend" bly en suksesvol deur ander organismes opgeneem word (Davison, 1999). Hierdie stukkie DNA sal egter net deel van die mikrobe se genetiese materiaal (genoom) word indien dit voordelig vir die organisme is (Ochman & Moran, 2001).

Die proses waartydens 'n organisme DNA vanuit die omgewing opneem, word transformasie genoem. (Davison, 1999; Salyers & Whitt, 2005). Twee ander prosesse vind ook gereedlik plaas, naamlik konjugasie, waar twee organismes fisies kontak maak en genetiese materiaal uitruil, asook die oordrag van genetiese materiaal deur bakteriofage (virusse wat bakterieë aanval), bekend as transduksie (Coughter & Stewart, 1988; Davison, 1999). Gewone evolusie deur mutasies (vertikaal) speel blykbaar ook 'n rol, maar die horisontale geenoordrag gebeur baie vinniger (Ochman & Moran, 2001).

Daar is 'n verskeidenheid van genetiese materiaal wat aan hierdie horisontale gene-oordrag kan deelnaam (Prescott, et. al. 1993), waaronder:

Plasmiede: Stukkies DNA wat nie deel van die chromosome van die sel uitmaak nie. Plasmiede kan hulself repliseer en dra dikwels kenmerke soos dié wat konjugasie vergemaklik asook een of meer kenmerke vir antibiotikaweerstandbiedendheid.

(Bakterio)fage is virusse wat veral bakterieë aanval en vernietig. Genetiese materiaal van die gasheer kan deel word van die virus en op 'n later stadium oorgedra word aan ander mikrobies.

Integrasies is ensieme waarvoor die genetiese materiaal op sekere fagegene gedra word. Hierdie ensieme sal dan DNA-oordrag tussen die fage en die bakterie vergemaklik.

Transposons is stukkie DNA wat die gene bevat wat stukke DNA op die genoom kan laat rondbeweeg.

Hierdie genetiese materiaal kom in die natuur voor, maar word ook in kunsmatige genetiese manipulasie ingespan.

Die "selfsugtige-geneteorie" beskou die oordraagbare DNA-materiaal as parasiete. Volgens die teorie is die voordeel wat uitgeruilde genetiese materiaal vir die organisme kan inhou, blote toeval (Heinemann & Silby, 2003). Dit blyk egter dat hierdie teorie slegs in sommige gevalle antibiotikaweerstandbiedendheid kan verklaar (Heinemann & Silby, 2003).

Antibiotikaweerstandbiedendheid

Antibiotika word deur sommige bakterieë en swamme vervaardig (Prescott et al., 1993; Salyers & Whitt, 2005). Swamme is eukariote en word dus nie deur die antibiotika geaffekteer nie, maar antibiotikaproduserende bakterieë moet hulself teen hulle eie antibiotika beskerm en daarom het hulle weerstandbiedende gene (Salyers & Whitt, 2005). Dit blyk dus asof antibiotikaweerstand bestaan het voordat die mens antibiotika ontdek of gebruik het (Salyers & Whitt, 2005). Dis egter duidelik dat die voorkoms van antibiotikaweerstand in die laaste paar dekades geweldig versnel het (Amabile-Cuevas, 2003; Smart & Marstrand, 1971), blykbaar te wyte aan horisontale gene-oordrag (Amabile-Cuevas, 2003; Davison, 1999).

Antibiotikaweerstand word deur drie meganismes verkry (Salyers & Whitt, 2005):

- bakterie produseer proteïene wat die antibiotika chemies verander
- pompe in die bakteriewand hou die antibiotikakonsentrasie laer as dodelik
- mutasies van die antibiotika se teiken sodat die antibiotika nie kan bind nie, alhoewel hierdie meganisme dikwels dodelik vir die bakterie is.

'n Ander verskynsel by prokariote wat moontlik 'n rol by antibiotikaweerstand kan speel, is die PSK-gene (post segregational killing genes). Hierdie gene produseer 'n stof wat 'n gifstof vir die gasheer is, maar terselfertyd die giftige effek onderdruk (Heinemann & Silby, 2003). Indien 'n vreemde plasmied 'n bakterie binnekom, sal hierdie gene die bakterie saam met die plasmied vernietig, sodat moontlike kompetisie (met die nuwe plasmied) uitgeskakel kan word. Volgens Heinemann & Silby (2003), funksioneer hierdie gene in die teenwoordigheid van antibiotika. Sou 'n bakterie met weerstandbiedendheid 'n vreemde plasmied inneem en dogterselle erf hierdie nuwe plasmied sonder weerstandbiedendheid, sal die antibiotika hierdie sel vernietig en slegs die dogterselle met die weerstandbiedende geen leef en plant voort. Op hierdie manier kan die PSK-gene dus wel 'n rol speel in die opbou van antibiotikaweerstandbiedendheid.

Die vraag ontstaan nou: waarom het antibiotikaweerstand 'n probleem geword indien dit 'n natuurlike proses is?

Die antwoord op hierdie vraag is nie eenvoudig nie en die omvang van die probleem word blykbaar nog nie begryp nie, maar navorsingsresultate dui daarop dat die vrylike gebruik van antibiotika deur die mens een van die oorsake is (Amabile-Cuevas, 2003; Salyers & Whitt, 2005; Smart & Marstrand, 1971).

Die oorsake van hedendaagse weerstandbiedendheid kan soos volg gegroepeer word: (Amabile-Cuevas, 2003):

Mutasies geselekteer deur antibiotikadruk Oorgeërfde gene van antibiotikaproduserende voorvaders

Weerstandbiedende gene uitgeruil met antibiotikaproduserende organismes.

In 'n eksperiment gedoen deur Tolba et al (2002), is bewys

dat antibiotikaweerstandbiedendheid nie noodwendig net deur antibiotikagebruik veroorsaak word nie. Analises van gronde uit 'n appelboord in Duitsland waar antibiotika gebruik is, 'n appelboord ook in Duitsland waar geen antibiotika gebruik is nie (kontrole), 'n weiding met riool bemes in Engeland en die laaste grond uit 'n koringland in 'n ander deel van Engeland, het almal bakterieë met weerstandbiedende gene teen streptomisiensulfaat gelever.

Hou in gedagte dat mikrobiese gene kan uitruil, dus kan daar slegs oor die oorsprong van die weerstandbiedendheid bespiegel word.

Meervoudige weerstandbiedendheid by bakterieë

Sekere bakterieë kan nie net teen 'n sekere antibiotikum weerstand kan opbou nie, maar meervoudige weerstand kom deesdae algemeen voor. Dit beteken dat 'n enkele siekteveroorakende bakterie skielik teen 'n verskeidenheid van moontlike antibiotika weerstandbiedend is (Amabile-Cuevas, 2003; Firth, 2003).

'n Spesifieke kenmerk wat op 'n stukkie DNA gedra word, word dikwels nie alleen oorgedra nie. Dit beteken dat, wanneer 'n sekere kenmerk oorgedra word, hetsy deur natuurlike of kunsmatige maniere, daar dikwels ander kenmerke "per ongeluk" oorgedra word. 'n Klassieke voorbeeld is die geneties gemodifiseerde mielies BT wat weerstandbiedend teen insekte is (Salyers & Whitt, 2005). In hierdie geval word daar 'n antibiotikaweerstandbiedendheid op dieselfde geen oorgedra. Die vrees bestaan dus dat hierdie geen aan die mens in sy spysverteringskanaal aan kolonbakterieë oorgedra kan word, met skrikwekkende moontlike gevolge vir latere operasies of siektes (Salyers & Whitt, 2005). Spysverteringskanaalbakterieë is onder normale omstandighede nie patogenies nie, maar tydens operasies beland hierdie bakterieë dikwels in gebiede waar hulle nie normaalweg voorkom nie en in hierdie nuwe omgewing (of tydens die verlaagde weerstand van die pasiënt) kan hulle wel infeksies veroorsaak (Prescott, et. al. 1993).

Sommige gene besit die vermoë om hulself te repliseer. Op hierdie manier kan 'n kenmerk soos weerstandbiedendheid nie net van een organisme na 'n ander een oorgedra word nie, maar kan die replika oorgedra word terwyl die donorsel nog steeds sy weerstandbiedendheid behou (Amabile-Cuevas, 2003). Soos stukke DNA met verskillende kenmerke, waaronder weerstandbiedendheid, tussen organismes uitgeruil word, kan stukke DNA van verskeie oorspronge in dieselfde sel beland en selfs deel word van die sel se eie DNA – meervoudige weerstand wat ook aan die sel se nageslag oorgedra sal word deur vertikale oordrag tydens voortplanting (Amabile-Cuevas, 2003).

Wat is die oorsaak?

In 1928 het Alexander Fleming, bykans per ongeluk, penisillien ontdek. (Prescott et. al. 1993). Sedertdien is antibiotika wyd en sydig gebruik. Bykans elkeen wat al met griep, 'n virus siekte, na 'n dokter gegaan het, is op 'n antibiotikakursus geplaas. Virusse word egter nie deur antibiotika geaffekteer nie maar die antibiotika word voorgeskryf omdat dit moontlike sekondêre infeksies voorkom.

Antibiotika word dus profalakties sowel as behandelend deur dokters voorgeskryf (Davies & Amabile-Cuevas, 2003; Salyers & Whitt, 2005). Mikrobiese ruil dus genetiese materiaal uit wat hul oorlewing – weerstand teen antibiotika in hierdie geval – kan verseker en die weerstandbiedendheid versprei.

Elke persoon wat ontsmettingsmiddels - antibakteriese seep, antibakteriese opwasmiddel en ontsmettingsmiddels - onnodig gebruik, dra by tot die probleem (Salyers & Whitt, 2005), aangesien die werking van ontsmettingsmiddels en antibakteriese middels baie dieselfde is as dié van antibiotika. 'n Ander probleem is mense wat 'n antibiotikakursus nie voltooi nie, omdat die simptome ophou. Hierdie laer as dodelike vlakke van antibiotika dryf ook die seleksie van weerstandbiedendheid (Salyers & Whitt, 2003).

Wat van die landboubedryf?

Alhoewel antibiotika vir menselike gebruik slegs op voorskrif beskikbaar is, en mens sou reken dat onnodige gebruik daarvan beperk is, is dié vir dierlike gebruik vrylik beskikbaar in Landbou Koöperasies en nie net aan bona fide boere nie. Reeds in 1971 was daar bekomernis oor die die verhoging in die voorkoms van antibiotikaweerstand in Engeland en het die regering reeds maatreëls begin tref om die wye gebruik van antibiotika veral in die landboubedryf te probeer reguleer (Smart & Marstrand, 1971).

Aangesien antibiotika dikwels ligte infeksies onderdruk, groei diere wat gereeld antibiotika kry, vinniger. Sommige boere gebruik dus antibiotika as groeistimulante, of profalakties waar diere in hokke aangehou word, of vir die behandeling van infeksies (Salyers & Whitt, 2003; Smart & Marstrand, 1971). Baie van hierdie antibiotika beland via diereafval in die grond en grondwater, ander beland in die produkte (vleis, eiers, melk) van hierdie diere. Dieselfde geld vir die behandeling van bakteriese siektes by plante.

Antibiotika, net soos enige ander gifstof of medisyne, het 'n spesifieke onthoudingstydperk. Persoonlike gesprekke met 2 veeartse en een dieregesondheidstegnikus, het die volgende Suid-Afrikaanse feite aan die lig gebring:

- Antibiotika word baie wyd in georganiseerde landbou gebruik, alhoewel die profalaktiese gebruik daarvan meer effektief is by nie-rumendiëre (visse, varke en pluimvee).
- Nasionale sowel as Provinsiale Departemente van Landbou toets vleis, eiers en melk op 'n gereelde basis.
- Boere word ingelig indien hoë vlakke van antibiotika in hul produkte gevind word – dikwels maande na die monsterneming, as gevolg van mannekragtekort en fondsbeperkings.
- Karkasmeel wat in baie dierevoere aanwesig is, word van afvalvleis gemaak – ook byvoorbeeld hoenders wat aan siektes gevrek het. Die sterilisasieproses van die karkasmeel behoort alle patogene asook antibiotika te vernietig.
- Baie voorafvervaardigde dierevoere bevat antibiotika in "aanvaarbare" vlakke.

Gevolgtrekking

Groot klem word gelê op kunsmatige genetiese manipulasie van organismes. Mens moet egter in gedagte hou dat hierdie kunsmatig gemanipuleerde organismes gewoonlik nie die kompetisievermoë van die vrylewendes het nie en die kans dat hierdie organismes "ontsnap" en probleme veroorsaak, is uiters skraal (Salyers & Whitt, 2005).

Antibiotikaweerstandbiedendheid is egter 'n realiteit (Amabile-Cuevas, 2003; Salyers & Whitt, 2003; Tolba et-al, 2002). In ons eie land hoor ons meer en meer van antibiotikaweerstandbiedende toring, om maar een te noem. Die ontwikkeling van nuwe antibiotika is 'n baie lang en duur proses – dit neem 10-15 jaar en kos ongeveer 800 miljoen Amerikaanse dollars (Salyers & Whitt, 2003) en is dus nie 'n goeie antwoord op die probleem nie.

Alhoewel antibiotikaweerstandbiedendheid op natuurlike maniere kan ontwikkel, het die wye gebruik van antibiotika en ander antimikrobiese middels beslis die proses verhaas (Amabile-Cuevas, 2003; Salyers & Whitt, 2005).

Elke persoon kan 'n bydrae lewer om die probleem van antibiotikaweerstandbiedendheid te beperk deur:

- Onthoudingstydperke streng na te kom en die druk van verbruikers in gedagte te hou. In Amerika vereis die groot kitskosgroep McDonalds sedert 2003 antibiotikavrye produkte van sy leweransiers (Salyers & Whitt, 2005).
- Antibiotika streng volgens voorskrif te gebruik wat die voorgeskryde dosis en die voltooiing van 'n kursus insluit.
- Seep en water in plaas van ontsmettingsmiddels vir alledaagse skoonmaakaksies te gebruik.

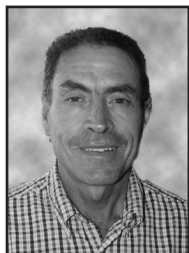
In die woorde van Salyers & Whitt: "The solution is in our hands – wash them!"

Bibliografie

1. AMABILE-CUEVAS, CF. 2003 Gathering of Resistance Genes in Gram-Negative Bacteria: an overview. In: AMABILE-CUEVAS, CF. (Editor). *Multiple Drug Resistance Bacteria*. Horizon Scientific Press, Norfolk, England. p. 9-31
2. COUGHTER, J.P. & STEWART, G.J. 1988. *Genetic Exchange in the environment*. *Antonie van Leeuwenhoek* 55:1; p. 15 – 22.
3. DAVIES, J. & AMABILE-CUEVAS, C.F. 2003. The rise of Antibiotic Resistance. In: AMABILE-CUEVAS, CF. (Editor).. *Multiple Drug Resistance Bacteria*. Horizon Scientific Press, Norfolk, England p. 1-7
4. DAVISON, JOHN. 1999. Review: Genetic Exchange between Bacteria in the Environment. *Plasmid* 42 p. 73 – 91
5. FIRTH, N. 2003. Evolution of Antimicrobial Multi-Resistance in Gram-Positive bacteria. In: AMABILE-CUEVAS, CF. (Editor). *Multiple Drug Resistance Bacteria*. Horizon Scientific Press, Norfolk, England p 33- 60
6. HEINEMANN, J A & SILBY, M W. 2003. Horizontal Gene Transfer and the Selection of Antibiotic Resistance. In: AMABILE-CUEVAS, CF. (Editor). *Multiple Drug Resistance Bacteria*. Horizon Scientific Press, Norfolk, England p.162-178
7. OCMAN, H & MORAN, N.A. 2001: Genes lost and genes found: Evolution of bacterial pathogenesis and symbiosis. *Science* vol 292. May.
8. PRESCOTT, L.M; HARLEY, J.P & KLEIN, D.A. 1993. *Microbiology*. 2nd Edition. Wm. C Brown Publishers, United States of America, Dubuque.
9. SALYERS, A.A. & WHITT, D.D. 2005. *Revenge of the Microbes*. ASM Press, American Society for Microbiology, Washington DC.
10. SMART, C C & MARSTRAND, P K. 1971. Antibiotic technology in agriculture. *Research Policy* 1 (1971/1972) p. 364-385.
11. TOLBA, S.; EGAN, S; KALLIFIDAS, D. & WELLINGTON E.M.H. 2002: Distribution of streptomycin resistance and biosynthesis genes in streptomycetes recovered from different soil sites. *FEMS Microbiology Ecology* 42 p.269 – 276.

My dank aan die volgende veeartse van Landbou Wes-Kaap: Drr Buhrmann en Kloppers en dieregesondheidstegnikus Me Swartz van Nasionale Departement van Landbou vir inligting rakende antibiotikagebruik in landbou in Suid-Afrika.

The effect of concentrate supplementation on the milk yield of Jersey cows on a pasture based diet



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Introduction

The optimum amount of concentrates to be fed to achieve profitable milk yield levels while maintaining good rumen health and reproductive performance of dairy cows is a commonly asked question by dairy farmers. The cost of concentrate feeding is usually the highest single cost item in the production of milk, making the amount fed an important aspect determining the profitability of a dairy operation (Burger, 2001). The effect of concentrate supplementation on the milk yield of dairy cows is well known, i.e. milk yield increases with higher levels of concentrate feeding. The response in milk yield however decreases beyond specific concentrate feeding levels. While earlier studies at the Outeniqua Research Station were based on the effect of higher levels of concentrate feeding on milk yield (Muller, 1982 and Muller, 1987), improved pasture types, cultivars and pasture management as well as economic implications have resulted in farmers reconsidering feeding maximum levels of concentrates. The profitability of concentrate feeding depends on (1) the price of milk and the price of grain, (2) the substitution rate of pasture caused by concentrate feeding and (3) the expected milk yield response to supplemental concentrates (Muller, 2001). Australian research (Stockdale, 1999) found that because of changes in pasture quality and quantity during the growing season, the response in the milk yield of dairy cows to concentrate supplementation differs substantially. During spring large amounts of high quality pastures are available while this is lower in summer and autumn. The variation in milk yield response ranged from about half a liter of milk for each kilogram of concentrate fed in spring to 1.5 litres of milk in summer-autumn. The response of cows is effectively based on the amount of energy supplied by the pasture available in the feeding programme of dairy cows. High levels of concentrate feeding especially when large amounts of high quality pastures are available, i.e. during the spring flush, could cause a substitution effect of the pasture. This means that a low cost feed (pasture) is replaced by a high cost feed (concentrate) having a negative effect on the economy of a pasture based feeding programme. In the USA Muller (2001) also noted that in a pasture based feeding system the continually changing quantity and quality of pasture during the grazing season and the lack of control of the feeding programme is a major challenge in obtaining consistently high feed intakes and profitable milk production levels. The goal in any production system is to provide a nutritionally balanced diet at the best cost for the system.

The objective of this study was to determine the effect of different levels of concentrate feeding on the milk yield, milk composition, liveweight change of Jersey cows on a pasture based dairy farm.

Materials and methods

The study was conducted on a commercial dairy farm situated near Caledon in the South Coast Region of the Western Cape Province. The trial started on 18 September 2000 and lasted for 6 weeks. Twenty Jersey cows in early lactation were divided according to average daily milk yield, stage of lactation (days in milk) and lactation number into two groups of 10 cows each. Average daily milk production of the cows in the two treatment groups during the pre-trial period was 26.2±3.4 and 26.0±4.5 kg respectively. The average lactation number of cows in the two groups was 2.8±1.5 and 2.5±1.4 and stage of lactation was 67±12 and 64±10 days post calving respectively. Groups of cows were allocated randomly to the two treatments. Two concentrate feeding levels were applied, i.e. High (on average 11.4 kg concentrates per cow per day)

and Medium (7.0 kg concentrates per cow per day). After each milking, concentrates were fed electronically to cows in individual post parlour feed bins. As all cows used in the experiment were in early lactation and initially on a high concentrate feeding level, the amount of concentrates fed to cows in the medium feeding level was reduced before the start of the experiment over a 7-day period. During the day, after the morning milking to the afternoon milking at about 15:00, cows had free access to a cultivated pasture consisting mostly of kikuyu and grass-clover mixtures under permanent irrigation. The pasture was fertilized according to soil analyses and standard practices for the region. The pasture was irrigated at least twice a week. At night cows were fed round bale oat silage and wheat straw in feed troughs in an open camp close to the dairy. Sufficient amounts of pasture, silage and wheat straw were provided to ensure an ad libitum daily feed intake. Cows were machine milked twice a day in 2 x 16 swing-over milking parlour. The individual daily milk yield of cows in each group was recorded three times per week. During the trial period, a milk sample of each cow was collected once a week at the morning and afternoon milking after which samples were combined for each cow, and combined. These samples were analysed at the ARC Laboratory at Elsenburg for the fat, protein and lactose percentage as well as milk urea nitrogen (MUN). Cows were weighed and condition scored (Mulvaney, 1977) at the start and end of the trial period. All production parameters were compared using the Statgraphics statistical package. A co-variance analysis was employed for milk yield and milk composition parameters.

Results and Discussion

The response in milk yield parameters as affected by the level of concentrate supplementation is presented in Table 1. The milk yield of cows receiving the medium concentrate level was not lower than for cows receiving the high concentrate level ($P>0.05$). Other parameters were also not affected by concentrate feeding level. Bargo et al (2000) found that supplementing cows on pasture with corn-based concentrate reduced the MUN content in the milk of cows. In the present trial MUN was not affected by feeding a higher concentrate level.

The milk fat percentage of cows receiving the high concentrate level was lower ($P<0.05$) than on the medium concentrate feeding level. This could be because the total fiber content in high quality pasture is often low in effective fibre not being able to stimulate adequate cud chewing and rumination resulting in a reduced milk fat content (Muller, 2001). The concentrate to forage ratio in the diet could also have affected milk fat percentage negatively. Based on an estimated total daily DM intake of 15 kg per cow, this ratio was 64:36 for the high concentrate feeding level in comparison to 39:61 for the medium concentrate feeding level. In a study conducted at Ellinbank, Australia (Stockdale, 1999) found that by providing 4.8 kg cereal grain and 5.0 kg lupins-cereal grain per cow/day to cows in addition to a mixed pasture consisting of white clover (*Trifolium repens*), perennial ryegrass (*L. perenne*) and paspalum, the milk yield of Holstein cows increased from 18.2 to 22.9 and 24.0 kg/cow/day respectively. The protein concentration of milk was not affected ($P>0.05$) being 3.16, 3.26 and 3.21% for the three treatments respectively. Milk fat concentration decreased ($P<0.05$) with grain supplementation being 4.26% on pasture and 4.22 and 4.21% on the cereal grain and lupin-cereal grain mixture. Feeding extra fibre as hay increased milk fat percentage to 4.27% (Stockdale, 1999). Stockdale (2001) noted that the first obvious sign that too much of a high-energy supplement is being fed is when a sharp decline in milk fat percentage occurs. Sub-clinical acidosis could

also occur resulting in cows going off feed. This could be overcome by feeding straw or hay although such feeds reduces the intake of pasture and therefore total energy intake of cows.

The change in average milk yield over the trial period is shown in Figure 1. The trend in milk yield was similar for both treatment groups. It must be conceded that the trial period was short and that changes in the pasture quantity and quality over time would affect the response differently. The response of additional concentrates above the medium level was low, i.e. 0.28 kg milk per kg of concentrates. According to Muller (2001) the response in milk production per unit of grain fed follows the law of diminishing returns. The first response is usually very profitable while each further extra unit of grain results in a lower return. The expected milk yield response for high

producing Holstein cows in early lactation with increasing increments of grain feeding varied from 1.2 to 1.4 kg milk/kg grain when grain feeding was increased from 0 to 2 kg per day while the increase in milk yield is 0.4 to 0.6 kg milk per kg of grain above 8 kg per day. Other studies with US Holsteins have reported milk yield responses of 1.3 kg (Bargo et al., 2000), 0.96 kg (Sayers, 1999) and 1.2 kg (Bertrand et al., 1999) per 1.0 kg grain fed. Overall, the average milk response to feeding 8 kg of grain per day is about 1 kg of milk per 1 kg of grain fed (Muller, 2001).

It has been suggested (Stockdale, 1999) that feeding cows high levels of concentrates in early lactation in spring may not be the key to profitable dairy production. Cows calving down in spring during the spring flush of pasture growth should rather receive some of their annual concentrate allowance during the summer and autumn to compensate for the lower quantity and poorer quality pasture available then as the energy content of the total diet is then also lower. The shortage of effective fibre in the total diet of cows could be the cause of poor milk yield responses to supplementary feeding in spring when high quality pasture is available, (Dalley, 2000). The milk yield of dairy cows as well as fat and protein concentrations in their milk are determined by the functions inside the rumen. Rumen fluid pH and the concentration of volatile fatty acids (acidic, butyric and propionic acids) are good indicators of how well the rumen is functioning. When the pH of the rumen fluid decreases, the rumen microbe types change and fibre digestibility is usually impaired. The digestion of fibre creates about 50% of the precursors of milk fat therefore a low fibre diet or disruption of fibre digestion usually result in a lower milk fat concentrations and poor responses to cereal grain or concentrate supplementation (Dalley, 2000). This was observed in the present trial with a lower milk fat concentration for cows receiving the high concentrate feeding level. This reduction in milk fat percentage would reduce the milk price and together with only a small response in milk

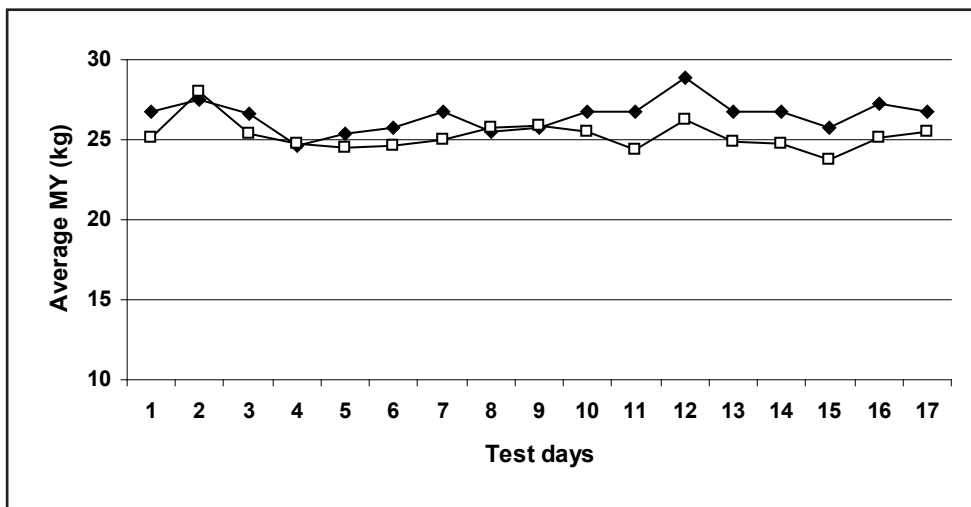


Figure 1 The average milk yield (MY) of two groups of Jersey cows receiving a High (□) and Medium (◇) concentrate feeding level as recorded on test days (17 test days over the 6 week trial period).

yield at a higher feed cost would affect farm income negatively. According to Muller (2001) when supplemental concentrates are fed, pasture dry matter intake decreases because of a substitution effect. At a higher concentrate feeding level a higher stocking rate could be employed in an effort to improve farm income. This would however increase the risk of a pure pasture based milk production system especially during seasonal and long term droughts. The stocking rate of a farm is increased when conserved forages and extra amounts of concentrates and/or by-products are fed. The response in terms of milk yield and farm income should however always be considered. The greatest benefit to concentrate supplementation may be long-term improvements in body condition as well as reproduction performance. This was not evaluated in the present study.

Conclusions

Providing concentrates at a high level increased milk yield by 0.28 kg/kg concentrates while milk fat percentage was reduced from 4.80% to 4.14%. This low response in milk yield is probably related to the availability of sufficient amounts of high quality pasture during spring. Using current milk and feed pricing structures, the medium concentrate feeding level resulted in an 8% higher margin above feed cost in comparison to the high concentrate feeding level. Further studies need to be conducted to determine the long term effect of feeding concentrates at lower levels on the reproductive performance of cows in a pasture based feeding programme.

Table 1 The response in milk yield parameters as affected by the level of concentrate supplementation (SEM = Standard error of mean, LSD = Least significant difference, P = Probability)

Parameters	Concentrate feeding level		SEM	LSD	P
	High	Medium			
Concentrate (kg/cow/day)	11.4	7.0	-	-	-
Milk yield (kg/cow/day)	26.4±1.0	25.3±1.0	0.7	3.1	0.45
Fat (%)	4.14±0.17	4.80±0.17	0.12	0.50	0.01
4% Fat corrected milk (kg)	27.1±1.5	27.4±1.1	1.0	4.0	0.88
Protein (%)	3.30±0.06	3.35±0.06	0.04	0.17	0.56
Lactose (%)	4.78±0.04	4.83±0.02	0.02	0.09	0.27
Milk Urea Nitrogen (MUN)	17.6±0.3	17.2±0.3	0.2	0.8	0.31
Start liveweight (kg)	370±11	366±12	8	34	0.81
End liveweight (kg)	380±9	374±10	7	28	0.63
Start Body condition score	2.25±0.21	2.30±0.19	0.14	0.60	0.86
End Body condition score	2.30±0.24	2.35±0.17	0.15	0.61	0.87

Acknowledgements

The study was conducted as part of the Farm Monitoring Programme initiated by the South Cape

Agricultural Research Society to improve pasture production and utilization. The support of Mr Willie van Niekerk of the farm Spes Bona in the Caledon district and the help of his milkers is greatly appreciated.

References

1. Bargo, F., Muller, L.D., Delahoy, J.D. & Cassidy, T.W., 2000. Milk response to concentrate supplementation of high producing dairy cows grazing at two pasture allowances. *J. Dairy Sci.* 83: 133 (Suppl. 1).
2. Bertrand, J.K. & Carlisle, R.J., 1999. Effect of concentrate feeding level on the production of Holstein cows grazing winter annuals. *Prof. Anim. Scientist.* 15: 164-168.
3. Burger, W.P., 2001. *Ekonomiese aspekte van melkbeesboerderye. Melkbeesvoedingskursusnotas.* Dept van Landbou : Wes-Kaap. Elsenburg. 7607
4. Dalley, D., 2000. Grain feeding questioned. *The Australian Dairyfarmer.* 15 (5): 56-57.
5. Muller, C.J.C., 1982. Die melkproduksiepotensiaal in die George-Knysna gebied: Evaluasie van voedingspraktyke vir melkkoeie. *Els. J.* 6 (1), 7 – 13.
6. Muller, C.J.C., 1987. Kragvoervoorsiening aan melkkoeie op aangeplante weiding in die George-omgewing. SAVDP-kongres. 6 – 9 April 1987. Pretoria, suid Afrika. p. 120.
7. Muller, L.D., 2001. Feeding the modern dairy cow. *Proc. SA Large Herds Conference.* 5-7 February 2001, Tsitsikamma. South Africa. p: 51-79.
8. Mulvany, P., 1977. Dairy cow condition scoring. *Nat. Inst. for Dairying, Shinfield, Reading RG2 9AT.* Paper no. 4468.
9. Sayers, H.J., 1999. The effect of sward characteristics and level and type of supplement on grazing behaviour, herbage intake and performance of lactating dairy cows. PhD Thesis. Queens University, Belfast, N.Ireland.
10. Stockdale, C.R., 1999. Effects of cereal grain, lupins-cereal gran or hay supplements on the intake and performance of grazing dairy cows. *Austr. J. Exp. Agric.* 39: 811-817.
11. Stockdale, C.R., 2001. Using high-energy supplements. *The Australian Dairyfarmer.* 16 (3): 67 & 69.