

SOIL FERTILITY — RESEARCH ACHIEVEMENTS AND THE NEED TO LINK NEW KNOWLEDGE TO FARMING PRACTICE

E. R. ORCHARD, Faculty of Agriculture, University of Natal, Pietermaritzburg

Introduction

Any attempt to review research achievements in the field of soil fertility must necessarily be cursory and inadequate. This is largely because of lack of opportunity for regular consultation between those directly concerned with such work whether they be Regional personnel of the Department of Agricultural Technical Services, those from specialist institutions or from private undertakings. Similarly the effective implementation of research findings in everyday farming practice must depend on close links between research and extension on the one hand, and extension personnel and the farming community on the other. There are some who feel that the first of these two links is still too loose and some of the ideas put forward here may reveal symptoms of this weakness. These difficulties should not, however dissuade one from attempting an objective review of the present situation with an eye to possible improvements.

South African agriculture has come a long way since the depression of the early thirties when guano was the mainstay on many a Western Cape farm, and our maize production was based very largely on an application of 200 lb superphosphate per morgen. Our older Colleges of Agriculture were founded mostly in the first decade of this century and the doyen of our Faculties of Agriculture, Stellenbosch, celebrated its 50th anniversary only last year. It was mainly at our Colleges and Faculties where a small band of devoted soil scientists and agronomists first investigated crop response to the major nutrients on South African soils. Largely by individual effort, men like Professors I. de V. Malherbe and J. S. Marais of Stellenbosch, J. C. Ross, J. J. Theron and D. G. Haylett of Pretoria, Dr A. R. Saunders at Potchefstroom, Dr T. D. Hall and others made major contributions, in spite of limited resources by present-day standards.

Fertility research — Current activities

Today the Department of Agricultural Technical Services maintains four Faculties of Agriculture, ten specialist research institutes, the seven agro-ecological regional organisations of the Republic and no less than sixty research stations and research units of various kinds. With the exception of those concerned primarily with the livestock industry, practically all deal to some extent with various aspects of soil fertility and crop response to mineral nutrients. To complete the picture of the total national effort directed to these ends, we must add the notable contributions of the sugar industry, the citrus industry, large corporations and companies engaged in agricultural production which maintain their own scientific staff, and finally the fertilizer industry itself. Had it not been for the enlightened policy initiated by the late Dr M. S. du Toit, at one time Secretary of the Department of Agriculture, of offering attractive study loans and bursaries and of seconding students for post-graduate training in research to the Faculties of Agriculture, both here and overseas, it would not have been possible to furnish all these undertakings, government as well as non-government, with professionally qualified scientific staff.

It is difficult to assess what proportion of the total effort is channelled into research at present but it is certainly not inconsiderable. Of the 2 423 registered research projects listed in the latest available summary *Agricultural Research*, (1967) prepared by Dr W. Geyer, Chief Director, Research, and published by the Department, 226 or approximately 10 per cent are specifically concerned with some aspect of soil fertility and crop nutrition.

The question of evaluating all this effort and expenditure inevitably arises. Inasmuch as publications may serve as an index, a study of the research report shows that of 364 recent papers by officers of the Department in scientific journals, 22 (6 per cent) dealt with some aspect of soils. Of 118 unpublished summaries of completed research projects, 29 deal with soils and soil fertility of which only four specifically refer to studies with maize. Of 101 theses submitted for higher degrees, nine were concerned with soils or crop nutrition.

These bare statistics which reflect the recent position, in no way serve to indicate the degree of sophistication and refinement attained by our agricultural scientists towards a thorough understanding of our soils, or of the as yet unfulfilled nutritional needs of the main crops produced in the Republic. A closer analysis of the current situation with respect to maize, our most widely grown crop, may serve to illustrate our attainments and our weaknesses. In the Highveld, OFS and Transvaal Regions a total of 36 officially listed current research projects deal with some nutritional aspect of maize production. To this may be added a further 18 projects in Natal which is not regarded as an important maize area.

Does research satisfy extension service needs?

It is true that our average maize yield per morgen is improving but it is still very low by foreign standards. It is also true that if existing information available on our research stations should be applied by our farmers, yields would show spectacular improvement. But there is little real comfort in these claims. In spite of our research work, it is still not possible to say whether the fertility status of our maize-producing soils is improving or declining. An attempt by Orchard (1) at drawing up a balance sheet indicates that the fertilizer applied in the 1962 season was inadequate to replace what was removed from the land in the form of grain. The impact of our national investment in fertility research could perhaps be gauged by the answers one might obtain to leading questions put to all those, both Departmental officers and others, whose business it is to advise maize producers on fertility matters. For example what would be revealed by replies to such questions as

- (a) What is the source and calibre of the information on which you base your advice?
- (b) Are you satisfied with the scientific basis on which fertilizer recommendations are made in your extension district?

- (c) Is any particular effort made to keep you informed on the recognition, characteristics and land-use aspects of the main soil types in your area?
- (d) Is any authoritative information available on the potential productivity or land-capability ratings of the local soils you deal with?
- (e) Do you make use of a soil-testing service, and if so, what degree of confidence have you in the outcome of predictions you make on the basis of your interpretation of soil test data?
- (f) What is the average delay between submitting samples for testing and receipt of the laboratory data?
- (g) Do you feel the need for improved communication of research findings at experient stations to extension staff in the field?
- (h) Do you consider the farmers in your extension district to be reasonably fertility conscious and is there evidence that they are becoming more insistent in their demand for improved fertilizer advisory services.

It is more than likely that a survey of this kind would reveal considerable scope for improvement in many facets of our scientific and extension work as well as in administrative and organisational aspects.

Co-ordinated effort can provide the answers

I am convinced that the calibre of Bachelors of Agricultural Science and of the post-graduates flowing from our Faculties of Agriculture in recent years is equal if not superior to their counterparts in other countries, particularly the USA. It also cannot be said that facilities provided for agricultural research in terms of funds and equipment are seriously inadequate, with the possible exception of technical assistance. There is, however, room for improving the manner in which our fertility-oriented research effort is co-ordinated and the results translated into practice. Our deficiencies become conspicuous when one observes the close liaison which exists in countries like The Netherlands, Australia, the various USA States at all levels between state authority, private enterprise, farmers' organization, the universities, research and extension agencies of various kinds. One need search no further than our own borders for examples where purposeful focussing of all available resources has led to outstanding success. I refer to the sugar industry in Natal which, without any assistance from the State, conducts intensive pedological, agronomic and fertility research work. Cane growers enjoy a very efficient fertilizer advisory service based on soil and leaf analysis adequately supported by data from numerous field experiments distributed over the major soil series of the sugarcane belt. A somewhat different but probably equally efficient service is available to South African citrus growers through their laboratory in Pretoria. The extension services of both these organizations are kept in close touch with all phases of laboratory and other relevant research findings. In both these examples the somewhat narrow field of interest has simplified the task of creating an efficient advisory service but close co-ordination has led to markedly improved production practices. In mixed cropping areas the problems facing the advisory service may well be more difficult but the solution requires application of exactly the same principles.

I am in no position to express a firm opinion on the efficiency of the soil-testing and fertilizer advisory services open to our maize, wheat, potato and other producers of major crops. One has the impression, however, that the outcome is still somewhat diffuse and beset by many uncertainties which might by now have been eliminated. It may well be found that the stimulus for improving the service will come from organized agriculture once farmers themselves realize more fully the advantages to be gained by paying more attention to the fertility status of their soils. The maize industry itself affords an example of how a well led and well co-ordinated project can lead to spectacular improvement. The vigorous hybrid maize breeding programme provides for regular conferences where various interested parties from every part of the Republic and surrounding territories meet regularly. Ideas are exchanged, progress reviewed, current projects are criticised and in this way weaknesses can be pinpointed and future lines of action planned. If similar interest were to be displayed in soil fertility aspects by financially competent commodity Control Boards, the results could soon match those established by the sugar and citrus industries. The stimulus generated by the free interplay of ideas between those with common interests was amply illustrated by the enthusiasm seen many years ago at a widely attended conference held at the College of Agriculture, Potchefstroom, to discuss the yellowing of maize. I am not aware that any similar meeting has since been called to consider other aspects of soil fertility. A similar opportunity to survey the scene with an eye to formulating plans for improved fertilizer advisory services may well have far reaching repercussions.

The Department of Agricultural Technical Services will inevitably be involved in any scheme to improve advisory services because official approval and support is essential if the confidence of the farming community is to be gained and all suspicion of domination by vested interests is to be removed. The Department has already contributed a major share towards this goal through research and the advisory services available at present. Fertilizer interests have made significant contributions, particularly through research work, field experimentation in the farming areas and the free soil-testing service offered to farmers over a wide period of many years. The reconnaissance soil surveys that have been sponsored in important food-producing areas will provide a valuable foundation for future developments.

There is also no doubt that South African farmers are becoming more fertility conscious and increasingly aware of the extra profits to be reaped by exploiting the full productive potential of their soils through improved fertilizer practices. More farmers are using more fertilizer and the steeply rising curves for P, K and particularly N consumption over the last six years, is evidence of this awakening.

Individual officers at various research centres of the Department are well aware of the need for improved fertilizer advisory services and are clearing the way for the next advance. A brief review of titles of some relevant research projects will illustrate the present position.

Navorsing — Huidige doelwitte

In die Hoëveldstreek op Potchefstroom is Grobler besig met 'n ondersoek van grondvrugbaarheid uit 'n

analitiese standpunt asook 'n reeks ander projekte met mielies oor verskillende aspekte van N, P en sink toediening. Een van sy projekte onder 'n sleutelprogram wat gemik is op die kern van die probleem verdien spesiale melding. Dit gaan oor 'n ondersoek van grondontleding as basis vir bemestingsadvies en behels die belangrike beginsel van instandhouding van veldproewe met die doel om opbrengsvermeerderings met grondontledingsdata te korreleer. Die noodsaaklikheid van sulke korrelasie- of kalibreringswerk het tot dusver nog nie die erkenning ontvang wat dit verdien nie maar dit is noodsaaklik alvorens die maatstaf of kriteria wat van pas is onder Suid-Afrikaanse toestande, met vertroue aanvaar kan word. Al is dit nog nie in amptelike publikasies gemeld nie, is 'n studie in hierdie rigting deur Koch, Ludorf en ander op Cedara Landboukollege aangevoer. Aan die Fakulteit van Landbou te Bloemfontein is 'n opname van die sinkstatus van OVS gronde afgehandel en onlangs gepubliseer deur Stanton en Burger. Fosfaatstudies op Vrystaatse gronde is aan die gang op Glen Landboukollege en Burger en Laker is besig met 'n opname van die vrugbaarheidsstatus van suid-sentraal OVS gronde.

Mikro-element opnames is aan die gang by verskeie sentra insluitende 'n belangrike bydrae in die Winterreënstreek. Graven het die noodsaaklikheid van mobiliteittoediening beklemtoon in die Oos-Kaap waar droëland-lusern op groot skaal gevestig word. Verskeie aspekte van die gebruik en invloed van kalk, insluitende 'n ondersoek van metodes om kalkbehoefte te bepaal, geniet aandag in al vier die provinsies maar veral in die Wes-Kaap en Natal waar intensiefgeploegde, suur gronde voorkom. Bykomstig tot sulke opnames wat dien om die algemene vrugbaarheidstatus oor relatief groot areas te karakteriseer, is daar talle ander navorsingsprojekte met meer omskreefde doelwitte. In Natal is 'n reeks studies onlangs afgehandel wat die moontlikheid aanbied om die potas-verskaffende krag van verskeie grondseries wat daar voorkom, te vergelyk en in rangorde te plaas. 'n Ondersoek oor uitruilbare Al en metodes om die Al aktiwiteit in suur Natalse gronde te onderdruk het ook nuwe lig gewerp op sekere faktore wat die toeganklikheid van P in hierdie gronde beïnvloed. Werk wat onlangs deur Graven onderneem is, dui aan dat baie Natalse gronde aan swaeltkort ly of beswaarlik kan voldoen aan gewasbenodigdhede. Hierdie waarneming sal begryplikerwys die fosfatiese kunsmisvorm wat aanbeveel word, affekteer. Mineralogiese, insluitende klei-mineralogiese studies, word tans onderneem in verskeie sentra in die Republiek asook bodenopnames en brakstudies van allerlei soorte.

Die grondslag vir advies aan boere

Wat ookal die prestasies van individuele grondkundiges of klein geïsoleerde groepe wetenskaplikes by die verskeie navorsingsinrigtings mag wees, en baie van hul werk is van hoog prysenswaardige gehalte, is dit nogtans nodig om te verneem wat die invloed van die groot totaal van hul bevindings op ons boerderypraktyke is. Ons het vandag hier te doen, nie net met navorsingsprestasies in terme van wetenskaplike publikasies en projekte nie, maar met die praktiese gevolge van die werk op die gebied van grondvrugbaarheid. Die mees direkte antwoord hierop kan moontlik gevind word deur te verneem hoe doeltreffend die kunsmisadviesdiens is wat tans tot beskikking van die boer is.

Hipotetiese vrae is reeds aan voorligters gestel. Veronderstel dat dit nou die beurt is van verantwoordelike beampptes in die landbouchemiese laboratoriums van die Streke om lastige vrae te beantwoord soos bv.

- (a) Wanneer u navrae van die voorligtingsdiens ontvang om inligting te verskaf waarop kunsmisaanbevelings vir 'n bepaalde plaas of gebied gemaak kan word, wat is die wetenskaplike basis en kriteria vir u antwoord?
- (b) Bied u bv. 'n gereelde grondontledingsdiens aan en indien wel, is daar 'n handleiding i.v.m. monsterneming? Welke chemiese metodes word gebruik om toeganklike N, P en K, en kalkbehoefte te bepaal? Word toetse gereeld uitgevoer op standaardmonsters om akkuraatheid en reproduseerbaarheid van resultate te kontroleer?
- (c) Watter bewyse bestaan daar dat die ontledingsdata redelik goed die vrugbaarheidstatus van die betrokke grond aandui? Is die empiriese metodes wat u gebruik ooit gekalibreer teenoor werklike opbrengsvermeerderings verkry met kunsmistoediening in veldproewe?
- (d) Vind u dit nodig om minimumpeile en ander kriteria te wysig om aan te pas by grondtipeverskille wanneer u ontledingsdata interpreteer?
- (e) Hou u boek van die gegewens wat met agtereenvolgende analyses verkry word van monsters van dieselfde land afkomstig, om sodoende vas te stel of die vrugbaarheidstatus verbeter al dan nie?
- (f) Is die gronde van u Streek reeds deur 'n ervare pedoloog geklassifiseer en word 'n voldoende aantal veldproewe op die mees belangrike grondseries uitgevoer om hul potensiale produktiwiteit onder optimale vrugbaarheidstoestande vas te stel?
- (g) Watter alternatiewe tegnieke, behalwe grondontleding, gebruik u om die verlangde inligting te verkry, bv. bladanalise?

Weereens is dit twyfelagtig of die antwoorde op hierdie en baie ander dergelike vrae altyd gerusstellend sal wees. Enige wetenskaplike aanvaarbare adviesdiens verg ongetwyfeld aansienlike aanvoorkerk. Die gekoördineerde werk en bydrae van vrugbaarheidspesialiste, skeikundiges, pedoloë, akkerboukundiges, biometrici en voorligters wat doelgerig streef, word vereis. Hierdie gesamentlike voorskrifte lê heelmoontlik buite die bestek van middele tot die beskikking van enige Streeks-hoofkwartier of ander dergelik afgesonderde groep wetenskaplikes. Daar is reeds op gewys dat fasiliteite vir die instelling van 'n verbeterde adviesdiens groten-deels reeds bestaan, maar om 'n werklike doeltreffende diens te skep sal meer aandag gegee moet word aan wetenskaplike en administratiewe besonderhede, insluitende uitvoerende gesag, indien 'n diens van nasionale omvang beoog word. Die mees doeltreffende dienste oorsê, opereer buite die staatsdiens alhoewel die Staat intiem betrokke mag wees. Die beste van hierdie dienste funksioneer in wat genoem mag word 'n 'besigheidsatmosfeer' waar 'n snel en doeltreffende diens teen 'n redelike prys gelewer word. Die boer, die voorligtingsdiens, die kunsmishandelaar, navorsingsdiens en die Staat is almal betrokke en idiaal behoort elk 'n seggenskap te hê, maar vinnige besluite is van tyd tot tyd nodig. Dit is moeilik te begryp hoe al hierdie belang gesamentlik onder staatsdiensregulasies sal kan opereer.

Geen enkele organisasie of navorsingsinrigting, hetsy die Departement Landbou-tegniese Dienste, die Navorsingsinstituut vir Grond, die kunsmisbedryf, die universiteite, die Bodemkundige Vereniging van Suid-Afrika, geeneen van hierdie kan aanspraak maak op 'n monopolie van kennis of ondervinding op die gebied van grondvrugbaarheid nie. Bevoegde persone kan egter uit hierdie liggame getrek word om gesamentlik besluite te neem of aanbevelings te maak oor belangrike punte soos bv. chemiese analitiese metodes, kriteria of peile vir N, P en K wat as voldoende beskou word, of 'n beleid van instandhouding of eep van vrugbaarheid opbou gevolg behoort te word en selfs of grondanalise wel die beste beskikbare basis is vir 'n kunsmisadviesdiens, e.d.m. Daar behoort minstens 'n forum geskep te word waar diegene wat 'n bydrae kan lewer die geleentheid gegee word om opinies te wissel, swakhede te identifiseer en toe te lig en om planne te beraam vir verbetering. Indien die welbedagte sienswyses en aanbevelings wat opduik gereeld bekend gemaak word by alle enigsins betrokke persone en instansies, en as geheel die ondersteuning geniet van 'n uitvoerende liggaam met fondse ter beskikking, kan die fundamente gelê word vir 'n diens wat volgens 'n deeglike en nuttige grondslag sal ontwikkel.

We are all aware that recommendations based on soil tests are open to criticism on scientific grounds in many respects. The basis is largely empirical and even the best services operating today do not claim more than a certain probability of correct prediction. Experience elsewhere has shown that there is probably no better vehicle for awakening the interest of farmers in fertility questions, and in this way improving fertilizer practices, than a well-run soil-testing service; this fact alone would justify a step in that direction.

Fertilizer policy in droughty areas

Farmers are cautious and quite justifiably will accept advice only if it can be shown that the outlay involved is likely to prove profitable. We are only too well aware of South Africa's capricious climate and the violent seasonal fluctuations to which our maize growing and other farming areas are subject. One may ask what is the reaction of a progressive maize farmer who has invested considerable working capital in the form of fertilizers, in accordance with the best available advice, when he is hit by widespread drought and crop failure as in the 1968/69 season. The reliability of the rainfall, as distinct from the amount or annual average, is known to weigh heavily with farmers in deciding on the amount and kind of fertilizer they are prepared to use. Current opinion also holds that under adverse climatic conditions adequately fertilized plants will out-perform those suffering even marginal deficiency. It would thus be sensible not to withhold fertilizer, but to temper rates of application in accordance with the calculated statistical probability of crippling drought. An alert advisory service may well take proper account of this aspect. Swaziland authorities have recently produced a map showing drought hazard contours in terms of the percentage of summers which receive a rainfall of less than 25 inches. The risk of drought naturally decreases as mean annual rainfall increases, so that the 20 per cent drought risk contour coincides with a mean annual rainfall of 40 inches, and increases to 80 per cent risk with a mean annual rainfall of 25 inches. Somewhat similar data are available in the Republic and it may prove rewarding to investigate the possibility of using such climatological data as a decision-making aid when formulating fer-

tilizer recommendations. A project worthy of the attention of our research workers would be to establish what proportion of the nitrogen and phosphate applied in a droughty year and not assimilated by the crop, will remain useful to plants in the following season. Farmers and their advisors would welcome such information and put it to good use. It should also be noted that soil testing is used as a basis for fertilizer recommendations to its greatest extent in the Eastern and Midwest States of the USA where rainfall is good and fairly dependable but falls off in popularity in a westerly direction as conditions become steadily drier.

Soil classification will simplify advisory work

Although the fertility studies of our older generation of soil scientists and agronomists paid good dividends, their work left certain gaps in the understanding of our soils which remain largely unfilled to this day. There are few parts of South Africa where large stretches of uniform soil are found; it follows that considerable diversity of soils is normal in most of our farming areas. These soils may differ in physical and chemical properties, in fertility status and in productive potential. Both the Regional research programmes and advisory work would be simplified enormously if it could be shown that certain characteristic patterns of behaviour, including fertility patterns, are associated with certain soil series. It would open the way to the very attractive prospect of making generalisations and predictions possible on the basis of a soil classification system in which individual series are recognized. Much of our soil research effort today suffers from the serious disadvantage in that it is difficult to state with any degree of certainty where the experimental findings will be applicable. Thus the practical value of yield response data from all field experimental work would have been much enhanced if experimental sites had been chosen on the basis of specific series rather than random distribution among better-class farmers or confined to conveniently allocated blocks on our experiment stations. A certain range of variability may be expected within any one series but differences between unrelated series are likely to be greater. There is evidence in Natal that such characteristic patterns of behaviour and response exist for some series at least, even when they occur at widely separated sites. Future work will show in how far generalisations will be valid for other series. Many of the 110 series identified in Natal and fully described in *Soils of the Tugela Basin* by v.d. Eijk, Macvicar and de Villiers (1969), are known to occur widely also in other important areas of the country. The prospect of applying research findings obtained in one Region to areas with similar soils elsewhere thus becomes a distinct possibility. If realized, this development could greatly accelerate progress towards a better understanding and appreciation of our soil resources. General acceptance of a national soil classification system based on series recognition could in due course be of great benefit to already existing soil testing services. This is because of the opportunity it offers for modifying and refining the interpretation of soil test data in accordance with behaviour characteristics towards added fertilizer, where this is justified by experimental evidence. For example, samples of two separate series may show identical soil test values for P but different phosphatic dressings may be recommended because of known differences in P fixing capacity. This example and others which readily come to mind, serve to emphasise the need for a great deal more co-ordinated inter-Regional research

and field experimentation on specific series. This approach seems to offer the best possibility of placing our extension and advisory services in a position to generalize i.e. of applying results obtained at one centre, with a fair degree of confidence also elsewhere.

The changing scene

We must accept that we live in a changing world. Fertility patterns change with time after new soil is brought under cultivation. The findings and practices of today may well be outdated tomorrow. We have seen in recent years how intensive cropping systems demand new solutions to fertility problems. The use of hybrids and higher plant population densities has suddenly increased the importance of nitrogen relative to that of other major nutrients. It is reflected in the national fertilizer consumption pattern where phosphate has only recently lost its hitherto dominant position to nitrogen. The N:P:K ratio in the fertilizer we use is also moving closer to the more balanced form seen in other countries. Minor element deficiencies may also be expected where none was noted before. At least a part of our research effort should be devoted to anticipating the answers advisory officers will require as these changes arise.

Many may disagree with views put forward here but they represent considered opinions reached after prob-

ing in this field over a long period. Most will, I think, agree that there is room for placing fertilizer advisory services currently available on a firmer footing. Those occupied in research may lose inspiration and justly feel frustrated unless their findings are seen to be translated into practice. Short periods of in-service training in a classroom atmosphere for extension personnel, fertilizer representatives and of leading farmers will be a logical development if quicker returns on our research investments are expected as new ideas are introduced.

South Africa's soil resources are limited, and by standards applied elsewhere, their productivity is not of the highest order; our soils have also unquestionably passed through an exploitative phase. But there is no doubt that considerable productive potential still lies untapped. It is up to our research and advisory organizations to equip themselves, by concerted effort, with the information which will inspire the farming community to tap hitherto unrealized potential by devoting more attention to better fertility management of their soils.

Reference

- (1) ORCHARD, E. R., 1964. Maize exports give food for thought. Fmg. in S Afr. Aug.

INLEIDING TOT BESPREKING

R. DU TOIT BURGER, Universiteit van die OVS.

Prof Orchard het 'n sterk pleidooi vir koördinasie gelever, m.a.w. 'n samesnoering van soveel individue binne elke organisasie en soveel belanghebbende organisasies en instansies as moontlik. Tereg is opgemerk dat daar in die Nederlande, Australië, VSA en ander lande 'n noue skakeling tussen staatsdepartement, privaat ondernemings, boere-organisasies, universiteite, navorsings- en voorligtingsinstansies van verskeie aard bestaan.

In ons goeie land is dit ongelukkig so dat hierdie noue skakeling nie deurgaans bestaan nie, miskien weens 'n verskeidenheid van omstandighede, maar miskien veelal weens 'n gebrek aan 'n sterk genoeg standpunt en inisiatief van 'n instansie, hetsy van die privaatsektor, die georganiseerde landbou of die staat. Ek is absoluut oortuig daarvan dat ons almal in ons wese daarvoor sou stem — want die bewys lê hier in hierdie vergadering, waar verteenwoordigers van 'n groot aantal belanghebbende instansies oor een saak beraadslaag. Individue op verskeie vlakke is maar te gretig om saam te werk, die enigste haperpunt is dikwels dat die masjinerie vir sodanige volle samewerking makeer.

Om koördinasie van grondvrugbaarheidsaspekte in sy gehele omvang te bewerkstellig moet alle belanghebbende instansies betrek word op 'n baie hoë vlak. Prof Orchard het baie duidelik daarop gewys dat individuele pogings, hoe lofwaardig hulle akademiese betekenis ookal is, slegs 'n beperkte toepassing het. Baie dikwels is sulke resultate slegs van toepassing op die unieke omstandighede waaronder hulle verkry is en in-terpreteerbaar deur die individu wat die eksperiment uitgeoef het.

Het die tyd nie nou aangebreek dat 'n sterk pleidooi gelever moet word vir 'n koördinerende liggaam soos tereg aangedui deur Prof Orchard nie? Ek wil derhalwe sy voorstel hier baie sterk onderskryf en die volgende ter oorweging in u midde lê.

Die daarstelling van masjinerie om 'n koördinerende Raad vir Grondvrugbaarheidsnavorsing en -advies te skep. Die inisiatief moet uitgaan van die Departement van Landbou-tegniese Dienste. Die volgende instansies moet verteenwoordig word op die Raad:

- 1 Die Navorsingsinstituut vir Grond
- 2 Die Misstofvereniging
- 3 Die Suid-Afrikaanse Landbou-Unie
- 4 Die Landbou-Streke: Winterreënstreek, Karoo-streek, Oos-Kaapland, Vrystaatstreek, Natalstreek, Transvaalstreek, Hoëveldstreek en Suidwes-Afrika
- 5 Die Navorsingsinstitute vir Vrugte en Voedsel, Sitrus- en Subtropiese Vrugte, Wynbou en Tabak
- 6 Die Vier Landboufakulteite
- 7 Die Bodemkundige Vereniging van Suid-Afrika
- 8 Die Sitrusbeurs en Suikervereniging.

Laasgenoemde twee instansies kan verteenwoordiging kry op grond van hulle navorsings- en adviesdienste wat reeds doeltreffend funksioneer, maar ander instansies soos die betrokke Landboubeheerrade, o.a. die Mielie-raad, Koringraad, Oliesaadbeheerraad, Sagtevrugteraad en Tabakraad moet dan ook nie summier oor die hoof gesien word nie. Dit is 'n debatspunt.

Bogenoemde instansies is groot in getal en so 'n Raad sal dus noodwendig aan die lomp kant wees. Vin-nige besluite wat van tyd tot tyd nodig sal wees is dus nie maklik uitvoerbaar nie. 'n Kleiner uitvoerende komitee kan aangewys word.

In aansluiting by die voorstel van Prof Orchard is dit ook vir my duidelik dat so 'n Raad buite die staatsverband moet staan, maar tog binne die dissiplinekring van die Staat.

Ek wil nie byvoeg by die funksies van die Raad soos geskets deur Prof Orchard nie, maar slegs uitbrei op die diensfasiliteite wat deur bemiddeling van die Raad daargestel kan word.

Ten eerste, navorsing ten opsigte van kalibrering van analitiese metodes. Prof Orchard het myns insiens 'n sterk genoeg motivering voorgelê dat die uitlê van bemestingsproewe gebaseer moet word op grondseries. Ons sien uit na 'n voltooide sistematiese opname van ons gronde. Kalibreringsveldproewe moet dus ontwerp word en uitgevoer word sodat soveel belangrike series betrek word as moontlik. Om die waarskynlikheidsfaktor vir voorspelling van oesresultate so noukeurig moontlik te maak, moet die aantal proewe ook so groot as prakties moontlik wees. Sommige navorsers stel dit op 'n minimum van dertig per grondsoort (serie, vorm of assosiasie).

Hierdie proewe moet op 'n georganiseerde basis ge-doen word — miskien eers slegs op goed-geïdentifi-seerde en gekarakteriseerde series en kan oor die jare uitgebrei word soos nuwe series geïdentifiseer word. Dit is in hierdie verband dat die opgeleide grondkundi-ges en agronome van die onderskeie kunsmismaatskap-pye 'n grootse bydrae kan lewer. Hulle het die vervoer-en ander fasiliteite van hulle maatskappye tot hul beskikking en kan 'n groot aantal veldproewe doeltref-fend beheer. Die proewe moet in samewerking met ervare agronome, grondkundiges en biometrici ontwerp word sodat die maksimum gegewens ingewin kan word, terwyl dit tog hanteerbaar moet wees. NPK is nie meer die enigste norme vir bemesting nie. Kalk, spoorelemen-te e.a. moet waar nodig ook betrek word. 'Partially confounded factorials' mag die antwoord bied.

Maksimum informasie moet ingewin word. Grond- en blaarontledings, oesresultate, weerkundige waarnemings en andere moet geïntigreer word in die interpreta-sie.

Wie moet verantwoordelik wees vir ontledings? Drie alternatiewe mag gestel word.

- (i) Alle bestaande analitiese laboratoria moet voort-gaan soos tans, maar op 'n gekoördineerde basis met ander woorde, metodes moet gestandardi-seer word en vryelike oor en weer kontrolering van analitiese noukeurigheid m.b.t. standaard-monsters moet aangemoedig word.
- (ii) Die staatslaboratoria moet alle analitiese werk doen of
- (iii) 'n onafhanklike dienslaboratorium moet daarge-stel word om op 'n besigheidsgrondslag beide roetine navorsingsmonsters en voorligtings-monsters te onderneem.

Laasgenoemde alternatief skyn vir my die aanneem-likste te wees, van 'n doeltreffendheidsoogpunt gesien. Hierbenewens sal dit ook vir die boer, wat vir die diens sal moet betaal, meer aanneemlik wees. Doeltreffend-heid en diens moet steeds voorop gestel word.

Williams & Rhiem stel voor dat monsters geneem word teen die tempo van een monster per 2 hektaar elke 10 jaar. Vir Suid-Afrika kom dit te staan op ongeveer 'n halfmiljoen monsters per jaar.

Interpretasie en die daaruitvloeiende advies bly steeds 'n probleem, maar kan deels verhelp word deur voor-gaande gekalibreerde analitiese prosedures op goed-geïdentifiseerde gronde. 'n Verdere noodsaaklikheid is opvolgingstudies in die praktyk. Dit behels noodsaak-likewyse die volgehoue samewerking van die boer en massas resultate. Ook opvolging van ontledings van gronde na gesette tye, sê elke vyf jaar.

Ten slotte dan die noodsaaklikheid van 'n doeltreffen-de stelsel van opgaring van massas syfers, die ver-werking daarvan en die periodieke bekendmaking daar-van. Hiervoor is 'n elektroniese rekenaar onontbeerlik. 'n Mens kan werklik lories raak oor die moontlikhede wat so 'n georganiseerde stelsel inhou. Net dit — ons kan nie meer bekostig om as individue op te tree en te dink nie. Ons moet groot dink. If we think of building a bridge across a river we must not think of building it crosswise but lengthwise.