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Conservation in Progress: a land manager survey.

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ABSTRACT

The current economic climate of financial constraint has led the Soil Conservation Service of NSW to undertake a review of its conservation farming program. As part of the review the Service has conducted a survey of current conservation farming practices. It is important to review the effectiveness of past extension effort in an area which has seen a reasonably high level of adoption of conservation farming practices. The Liverpool Plains was selected with a view to analysing the reasons for the apparent success and fine tuning the future extension effort to further the adoption of conservation farming practices.

This paper reports the results of the survey by interview of 81 land managers of the Liverpool Plains. The survey was conducted during May-July 1989. The plains were divided into 6 clusters of homogenous landuse. The Liverpool Plains are a predominantly cropping area in northern NSW. It is endowed with rich deep black soils and a climate which enables both summer and winter cropping.

The survey sought information on a number of conservation farming extension relevant areas. The broad areas covered during the interview include: the place of pastures, the use of chemicals, crop rotation and residue management, machinery selection, perceptions of productivity change and the land manager's source of extension information.

The survey results have provided concrete, objective support to the 'gut feelings' of experienced workers in the field. The survey has also drawn attention to several areas which may have otherwise been overlooked.

The Service is adjusting its conservation farming policies, where appropriate, to more efficiently and effectively advance the adoption of conservation farming practices in this area and elsewhere in the state.

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INTRODUCTION

This paper puts forward the main findings of a survey conducted by interview of 81 land managers of the Liverpool Plains in Northern NSW. The survey was conducted to ascertain the stage of uptake of conservation farming practices in the area. The information provided by the survey has been used to fine tune the conservation farming activities of the Soil Conservation Service in the immediate area. Limited extrapolation from this information may also be useful in modifying the conservation farming programs and extension efforts in other areas with similar agricultural activity and empathy for conservation farming.

Funding for the survey was provided by both the Commonwealth Government, through the National Soil Conservation Program, and the State Government through the Service's Conservation Farming Program.

Survey area

The region surveyed is bounded by Quirindi in the east, Gunnedah in the north and Premier in the west. The survey region was divided into 6 relative homogenous clusters. The cluster boundaries were determined on landuse, geographic and demographic criteria. Cluster 1 covers the Mullaley area, covering a portion of the Cocks Creek valley. This area has black soil slopes grading to red/brown soils. Cluster 2 covers the Lake Goran to Breeza area. This is a centrally draining area of deep black soils which is dominated by floodplain/lakebed cropping. This area is currently the focus of salinity investigations. Clusters 3, 4 and 5 are areas centred around the towns of Premier, Blackville and Plum Ridge. Each of these clusters grade from the footslopes of the Liverpool Range (SCS Land Capability Class IV and III) with some red/brown soil ridges through to SCS Class II, black soil valley floor/ floodplain cropping land. Cluster 6 is immediately south of Gunnedah and is the cluster most dominated by mixed farming. The soils grade from light sandy soils to red ridge country (SCS Class III). This area could also be described as having tired cropping soils. Each cluster is separated by ridges of non-arable land. The location of each cluster is depicted in Map 1.

Survey methodology

A sample size of 100 was selected due to time and financial constraints. The sample was drawn by geographic frame within each of the 6 clusters. A sample list of 114 target properties were thus selected which yielded 81 interview respondents. The sample size for each cluster, 1 to 6 are 7, 14, 11, 17, 18, and 14 respondents respectively. The three eligibility criteria for inclusion in the survey were as follows:

- 1 Area operated is greater than 200 hectares.
- 2 Arable area makes up at least 60% of farm area
(Not necessarily cropped at present).
- 3 Less than 50% of cropping is irrigated.

The questionnaire consisted of 40 questions and was filled out by the interviewer. The questionnaire was divided into 8 general topics of interest. These were

- I farm structural information
- II the role of pastures
- III the use of chemicals
- IV residue management
- V crop rotation management
- VI perceptions of productivity change
- VII machinery selection
- VIII the land manager's source of extension information

The interviews were conducted by one interviewer over a six week period from May to July, 1989. The Service was not identified as the originator of the survey. The interview was introduced as being funded by the Commonwealth Government. This was done in an attempt to minimise the bias introduced by the moral hazard of the Service asking questions about conservation. The questionnaire and results for the whole survey are available from the author on request.

SUMMARY OF RESULTS

A survey of this nature generates a large quantity of data. The discussion of survey results in this paper is confined to those which have major significance for the Service. Their significance may be due to the support they give to existing Service policy or that they suggest a variation of policy is required. Other results, though interesting in that they are contrary to a priori expectations, are not discussed.

1 Structural detail

81 land managers were interviewed. The area they manage amounts to 138,673 ha or 31 % of the total area covered by the survey. The average area operated by each respondent is 1,712 ha, although, the median is in the category 1,001 - 1,250 ha. The median area presently cultivated per property is in the category 501 - 750 ha. Figure 1 displays the mean area per property of each cluster and the mean area presently cultivated. Cluster 1 has the largest mean property size of 2700 ha with cluster 6 having the lowest mean size of 1050 ha. Clusters 5 and 6 are least cultivated at present (approximately 50%) while clusters 1, 2 and 4 are presently cultivated to the 70% level. Cluster 3 is presently 61% cultivated.

Figure 2 displays the proportion of income derived from livestock and grain activities for the whole survey. The graph shows that the survey respondents rely mainly grain growing for their income. Cluster 4, with the highest proportion presently cultivated (75%), has a mean income from grazing per property of 23%. Cluster 6, with a proportion presently cultivated of 52%, has the highest mean income from grazing per property of 51%. Figure 3 displays the age distribution of the land managers surveyed. Cluster 6 is dominated by managers in the 31 to 40 years age group (71%), while all other clusters exhibit a more statistically normal distribution about the 41 to 50 years age group.

Prior to the survey the immediate prospects for the sheep, beef and grain industries were reasonably steady. The relative economic position of the wheat, sheep and beef enterprises was probably slightly in favour of the beef industry at the time of the survey. Those land managers who were in a position to switch resources into this activity for minimal capital outlay, were expected to have done so. The physical resources of the plains and the selection criteria used for this survey will probably mean that cropping activities will, however, remain the dominant enterprise amongst these respondents.

Figure 4 displays the landuse stability over the last 5 years and the stated proposals to increase grazing in the future. Over the last five years 10% of respondents increased grain production and 40% have increased grazing. Cluster 3 was the most stable with 82% reporting no change. Both clusters 5 and 6 were least stable (33% and 36% reporting no change respectively) with 66% increasing grazing in cluster 5 and 50% increasing grazing in cluster 6. 49% of all respondents indicated that they did not propose to increase the proportion of the property used for grazing while 30% indicated that the increase would be between 1 and 20%. In cluster 2 only 21% of respondents propose no increase in grazing. Cluster 1 and 6 propose no change at the 86% and 71% level respectively. The remaining 3 clusters propose no change at approximately the 50% level. This response was registered before the wool industry problems of late 1990.

II Pasture

Approximately 50% of respondents in all clusters consider that a pasture phase will be necessary in future rotations on both red and black soils. Two improved pasture species were identified, lucerne being most often reported except in cluster 1, and clover being reported by more than 50% in clusters 2, 4 and 5. Figure 5 depicts the improved pasture species currently used by all respondents. The advantages of improved pasture were seen as production and soil improvement. The disadvantages were reported to be bloat (reported across all clusters) and lack of persistence (reported in clusters 3 and 5).

Pasture establishment was not generally perceived to be a problem, probably due to the species and method of establishment currently used. Figure 6 depicts the most successful method of improved pasture establishment used by all respondents. The same two methods of improved pasture establishment dominate each cluster. The most preferred methods of seed bed preparation are finely worked, stubble free, spill, harrow 56%, (FSFSH) with drill, harrow, (FSFDH), also mentioned (14%), and undersown with cereal crop, 46%. Only one respondent in cluster 5 reported using presswheels for pasture establishment. The cross-tabulation of method of establishment and establishment reliability indicated that 60% of respondents consider their methods to be 90-100% reliable.

III Chemical sprays

There was a very high adoption of chemical spray technology in all clusters with all respondents reporting use and 62% reporting having spray equipment. Figure 7 displays the situation in which chemical sprays were used. Pre and post-emergent spraying is reported by approximately 80% of all respondents. The high level reported for the use of chemical sprays for salvage operations may be a feature of the wet conditions during seedbed preparation over the last few years. The major advantages of herbicides are seen by all respondents as being weed control (94%) and less soil damage (26%). While all clusters registered high response rates for weed control there were significant differences between cluster responses: rates for less soil damage as an advantage of herbicide use. Less soil damage was seen as an advantage of herbicide use by 57% of cluster 1 respondents, clusters 2, 3 and 5 reported approximately 35% response rate while cluster 4 and 6 showed insignificant levels of responses. Moisture control was recognised as an advantage of herbicide use by only clusters 1, 4 and 5 (approximately 30%). 27% of respondents were concerned about the use of herbicides for reasons relating to both environmental issues and crop damage.

IV Crop residue

A high rate of retention of crop residue is apparent in the area surveyed with only 2 of the 81 respondents not retaining crop residues as a general part of the farming program.

Reduced erosion was the most common reason for retaining stubble reported by approximately 60% of the survey respondents although cluster 2 reported only 42%. Clusters 1, 3 and 6 report that they retain stubble because it reduces erosion (60% - 70%) but only 30 - 40% of respondents indicate that erosion is reducing their productivity. The second ranked reason for retaining stubble was soil tilth/structure (58% of all respondents) although clusters 3 and 6 reported approximately 40% each. Moisture storage was reported by 32% of respondents with clusters 4 and 6 registering less than 20% each. Nutrient benefit was supported by cluster 2 (21%) as a benefit of crop residue retention while only 28% of cluster 1 respondents regarded nutrient tie up as a disadvantage of stubble retention.

While retaining stubble is a widespread general farming practice, a high proportion of respondents have burnt some stubble in the past five years. The respondents report that the main reason for burning stubble was that they had too much straw (27%) with disease (17%) being the other main reason.

V Crop rotations

Crop rotations are well established with only 9% of the total survey respondents reporting continuous monoculture. Figure 8 depicts the most common rotations for all respondents. The 3 year fixed rotation, usually Wheat, Sorghum, Fallow is the most common rotation across the survey as a whole with the range from cluster 3 reporting 91% to cluster 6 reporting 57% usage. Cluster 5 reports 44% use of both 3 and 4 year fixed rotations. Pasture in a rotation is used the most in cluster 6 (64%) with practically no reports in clusters 3 and 4. Opportunity cropping is significantly reported in cluster 2 only (36%).

The whole survey reports that the major reasons for following a rotation are crop nutrition and weed control with approximately 50% reporting each. Crop nutrition was strongly supported (50%) as an advantage of rotation in each cluster except cluster 3 (18%). The distribution of reasons between the clusters is quite variable. Cluster 3's predominate response is moisture conservation (54%) while cluster 1 reports soil conservation (57%), nutrition (43%) and is the only one to report yield (43%). Cluster 6 reports nutrition (57%) and weed control (50%). Cluster 2 was the only one to include soil structure (21%) among the reasons for following a rotation.

VI Productivity

There is a high reported use of soil tests in all clusters with only a few respondents in clusters 1 and 6 reporting no soil testing. Cluster 1 reports only a 30% use of fertiliser while all other clusters reported 50% or better.

Just under half of respondents in all clusters consider that soil erosion is not affecting productivity. Of those who recognise declining productivity due to erosion, gully erosion is the most reported form particularly in clusters 3 and 6. Sheet erosion is regarded as a factor in productivity decline by approximately 30% of all respondents.

Nutrient loss (49%) is the dominant form of non erosion productivity decline recognised by the whole survey. 43% of respondents did not recognise any form of non-erosion productivity decline. Figure 9 depicts the survey responses to the question: 'Do you feel that productivity is declining for soil related reasons other than erosion?' Productivity was not recognised as declining for soil related reasons other than erosion by the majority of respondents in clusters 1 (71%) and 4 (64%) while the proportion in clusters 3 and 6 are approximately 40%. In clusters 2 and 5 only approximately 25% of respondents do not think productivity is declining for soil related reasons. Nutrient loss is the most recognised reason for productivity decline in clusters 2, 3, 5 and 6. During the survey the salinity problem in this region was not publicly discussed as indicated by its very low recognition as a source of soil related productivity decline (5 respondents). It is expected that the recent revelations concerning rising water tables in the area may incline the land managers to give a more sympathetic hearing to the proponents of pasture in their rotations.

VII Machinery

Farming machinery which has the capacity to be used in a 'soil friendly' manner is available to a large number of the respondents of the survey in total. The farming equipment that land managers have is displayed in Figure 10. The chisel plough is the most common implement reported by 83% of respondents.

More important than the ownership of equipment is the use to which it is put. Of the range of equipment options used to control first weeds immediately after harvest, chisel ploughs are used most often by 68% of the whole survey. This is also reflected in the cluster figures, with all except cluster 6 reporting approximately 75%. Cluster 6 reports only 43% use of chisel ploughs with one-way discs (71%) being their most often selected equipment to control first weeds. Off-set discs are preferred as an option to control

first weeds by 12% of managers aged less than 50 years and 38% of managers over 50 years of age.

Control of secondary weeds or seedbed preparation is dominated in cluster 6 by the use of scarifiers (93%). All other clusters reflect an even spread of implement choice with approximately 40% for each of wide-line, scarifier, chisel plough and chemical spraying.

Winter crop planting equipment is shared between Gyrál wide-line (36%), cultivator/wide-line with airseeder (23%) and combine (35%). Summer crop planting is dominated (approximately 55%) by row crop planters in clusters 1, 2, 3 and 5. Land managers in cluster 4 prefer Gyrál wide-line's (47%) while cluster 6 preferences are evenly shared with approximately 25% of respondents using each of combine, Gyrál wide-line and row crop planters.

VIII Extension methods

It is apparent that most of the general information about rural industries is obtained, by the survey respondents, from three sources. The three mediums are 'The Land' newspaper 72%, field days 57% and print (magazines) 26%. Figure 11 depicts the land managers sources of general information about rural industries for all respondents.

The Service is not perceived by the respondents as a source of agronomic advice. Specific agronomic advice is sought from the Department of Agriculture & Fisheries by approximately 50% of respondents in all clusters except cluster 1 (28%). Another source of agronomic advice is the chemical re-sellers. The combined chemical re-sellers are approached for agronomic advice by 75% of respondents. This level of contact is consistent across all clusters except 1, where only 43% approach chemical re-sellers.

DISCUSSION

The results presented above are interesting in that they gauge progress towards the theoretically unattainable, ultimate conservation farming community. The ultimate conservation farmer is one who continues to maintain economic levels of agricultural production while not diminishing the short and long term viability of production from the available resources. As this is an ever moving target, due to economic and technological change, we can only gauge extension success by the distance the land managers have moved from their past positions. This can be achieved by effectively promoting less erosion/degrading practices and taking a longer term view of the productive capability of the resources.

The land managers surveyed are using many of the conservation farming practices recommended for their area. The survey has contributed the following challenges for extension workers. Some of the challenges have been fully or partly addressed by previous extension work. Some challenges have been identified before (Perman and Patrick 1987) and remain to be effectively addressed.

The extent of pastures on the plains is expected to ebb and flow within the cropping rotation as the relative short term enterprise economics dictate unless the long term advantages of maintaining pasture are effectively extended to the land managers by the Service and others. The advantages include soil tilth/structure, weed and disease control and water balance implications among others.

Though half the respondents recognise that a pasture phase will be necessary in future, there is the limited experience with improved pasture grasses (see figure 5). This could be overcome with identification of appropriate species, demonstration of reliable establishment methods and extension to the land managers of the role of grasses in soil structure improvement.

Lucerne and clover may be close to their adoption limits, 62% and 41% respectively. Presswheel technology for both crop and pasture establishment may prove to be a

significant technology development to enable the cost effective establishment of pasture grasses. This could be the focus of future extension campaigns.

The impact of specific crops, crop rotations and pastures on the water balance, water tables and soil structure in these catchments needs to be investigated. The areas which are anticipated to have a high water table problem in the near future may be in a position to ameliorate the effects with pasture.

Extension effort could be fruitful in raising awareness of moisture control, less soil damage, timeliness and labour savings as advantages of herbicide use while encouraging proper and careful use to counter environmental concerns and reduce the risk of crop damage.

Past extension efforts have apparently been successful in that stubble retaining practices have been adopted by the land managers. The extension effort has, however, apparently not engendered a full understanding of the reasons for doing so. This would account for the relatively high regression to stubble burning when conditions deviate from 'normal'.

Some extension effort could be put to raising the recognition of the relationship between crop residue and moisture status, i.e. stubble reduces runoff and increases infiltration. The poor relationship between stubble and soil structure needs to be highlighted and the beneficial impact of grass pastures on soil structure emphasised. Extension and demonstration could be directed at overcoming both of the nominated reasons for stubble burning. The demonstration and extension of advice regarding stubble handling techniques and machinery should contribute to a reduction of stubble burning. Promotion of the disease control features of a crop rotation is also required.

As in the case of retaining crop residue, rotational cropping is well established but extension effort could effect better decision making if the managers understand more fully both the advantages and disadvantages of their rotations. The relationships between the rotation, disease and moisture control, if better understood, may offer more scope for opportunity cropping. The extension to land managers of the relationship between a crop rotation and water balance could contribute to overcoming problems associated with rising water tables in clusters 2, 3 and 4 particularly. The relationship between crop rotations and nutrition, with respect to pastures and legume crops, is apparently not clearly understood and would therefore be a worthwhile topic of further extension.

Research programs need to be developed which address both the short and long term questions of the productivity impact of rotations, stubble retention, erosion and other forms of soil modification induced by agricultural activities. When this research has been completed, effective extension in a clear and concise form is required. This may involve demonstration in local areas. Due to the lack of Service resources and profile in the agronomic extension field, a more effective method might be to use extension personnel from other organisations.

The majority of land managers are, apparently, not convinced that productivity is declining for erosion or any other soil related reason. This may be the case due to the inclusion of a productivity gain directly attributable to technological change. If, however, we could account for the 'technological change' component of the production equation (Males et al 1990), productivity may be declining due to erosion or a number of other reasons. This is a subject worthy of further investigation.

The reason for non-use of available equipment is probably associated with the whole range of agronomic factors as well as personal preference and habit. A number of these factors (crop rotations, moisture and weed control, soil structure, nutrients etc.) have been addressed elsewhere in this paper. It does not appear that the capital investment in machinery is a limiting factor to the adoption of the more soil 'friendly' cultivation practices. Age of the land manager (experience) does have an impact on

equipment use. This is probably the hardest factor to overcome in the adoption of new/different practices.

The peculiarities of cluster 6 with respect to soil type and weed problems ought to be investigated to see whether this cluster should be the target for a special extension program.

The Service's conservation farming and general extension effort should target the three sources of information. The first of these is the statewide circulation of the rural weekly paper 'The Land'. The research section of the Service is addressing this through the recent appointment of a Research Liaison Officer. It is understood that there has been an opportunity offered to the Service to take up a regular specialist column in 'The Land'. Local Information and Public Relation Officers are effectively gaining exposure in local newspapers as well as in 'The Land' newspaper.

Maximum opportunity should be taken to influence the subject matter of, be included in and conduct field days. 57% of respondents get general information from field days (consistent across all clusters). Approaches to those conducting field days should be made with a view to influencing the program or being included as a speaker. Care should be taken to ensure a professional presentation and that high quality and informative documentation is provided.

In a concerted effort, the Service could target the 10 or so chemical re-sellers by inviting them to a 'specialist workshop' for initial exposure to soil related agronomic information. After this initial phase, contact could be maintained with these people encouraging access to the Service as a consulting expert on soil related agronomics, and to be included in field days and small group discussions.

Agronomic advice is also sought from other farmers (48%). It is important for all extension staff to be aware of this fact and treat farmer contact with the appropriate respect.

It is considered that there is sufficient known challenges to fully occupy the Service's extension program as well as the research program. Further surveys of this nature would undoubtedly contribute additional locally specific challenges, but they will be ineffective until the underlying, already identified challenges are overcome. A more efficient and effective approach would be to have greater confidence in the local expert's capacity to modify (using gut feeling) the already known challenges and develop local strategies to address them rather than regular recourse to costly surveys to re-determine innovation adoption/rejection theory (Yapp and Connell 1989). There is a place for the survey as a tool, among others, for determining the demographic characteristics of the target population. The information required is more akin to that of market intelligence. This will enable extension services to be directed to the relevant land managers, rather than using a 'shot gun' approach.

CONCLUSIONS

The survey results have provided concrete, objective support to the 'gut feelings' of experienced workers in the field. The survey has also drawn attention to several areas which may have otherwise been underestimated. It now remains for the Service's policy makers to adjust policies, where appropriate, and for extension staff to more efficiently and effectively advance the adoption of conservation farming practices.

It is recommended that further conservation farming surveys, where necessary, be aimed at identifying population characteristics. This will enable the precision delivery of extension services.

The Service with its interest and expertise principally associated with the soil resource, is contributing by providing structural solutions and extension in the short term. In the longer term the Service is investigating both the negative and positive implications of man's modifications of the environment.

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MAP 1. LOCATION OF SURVEY CLUSTERS.

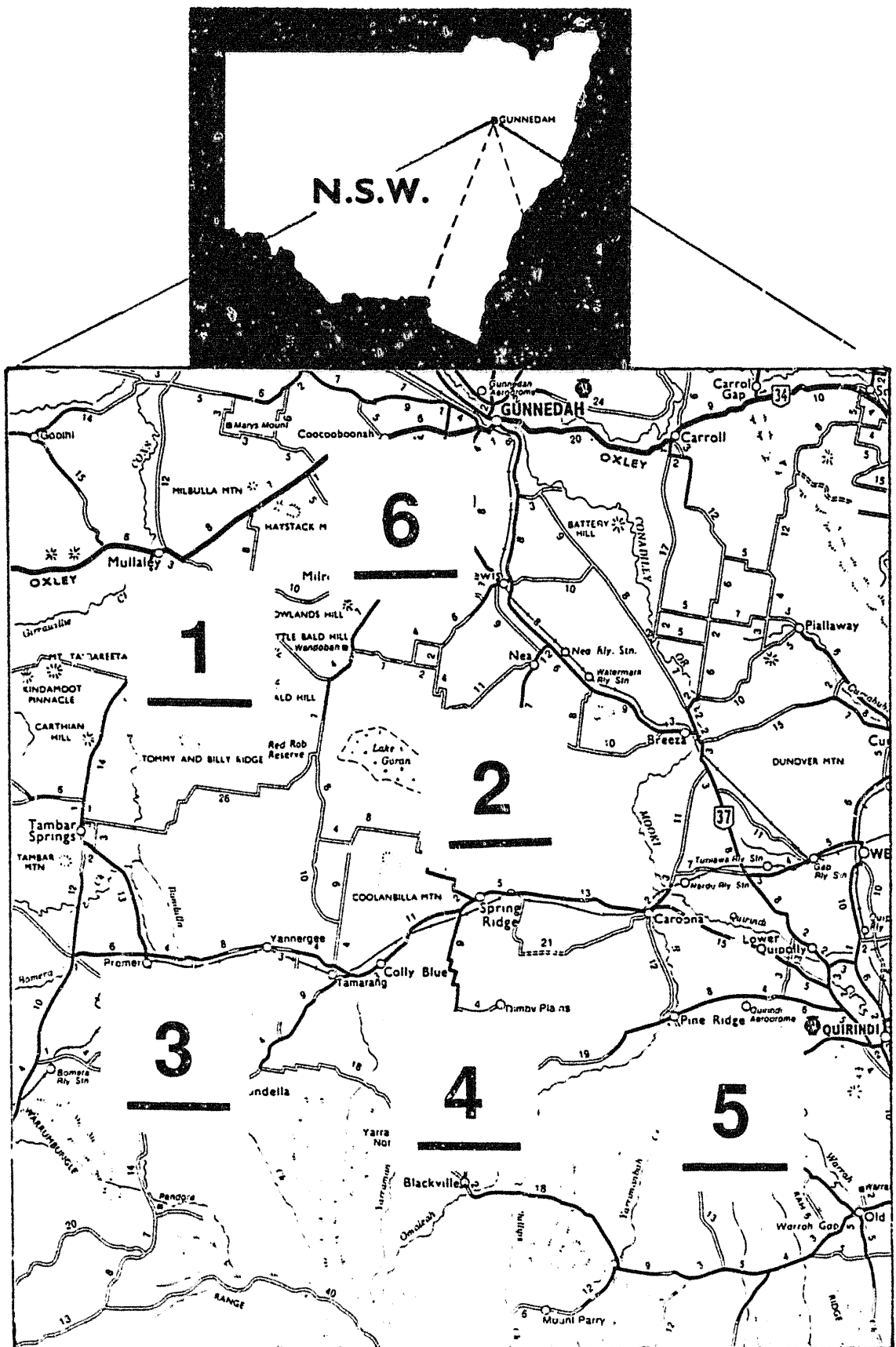


FIGURE 1. MEAN PROPERTY AREA AND MEAN AREA CULTIVATED.

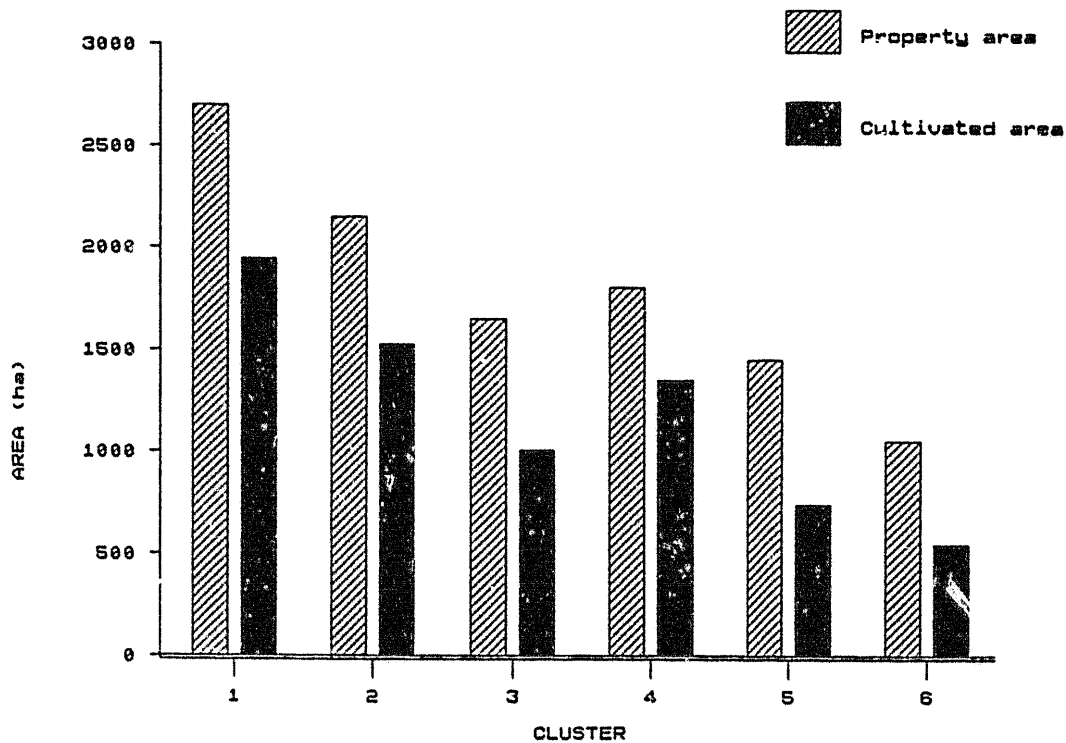


FIGURE 2. SOURCE OF INCOME.

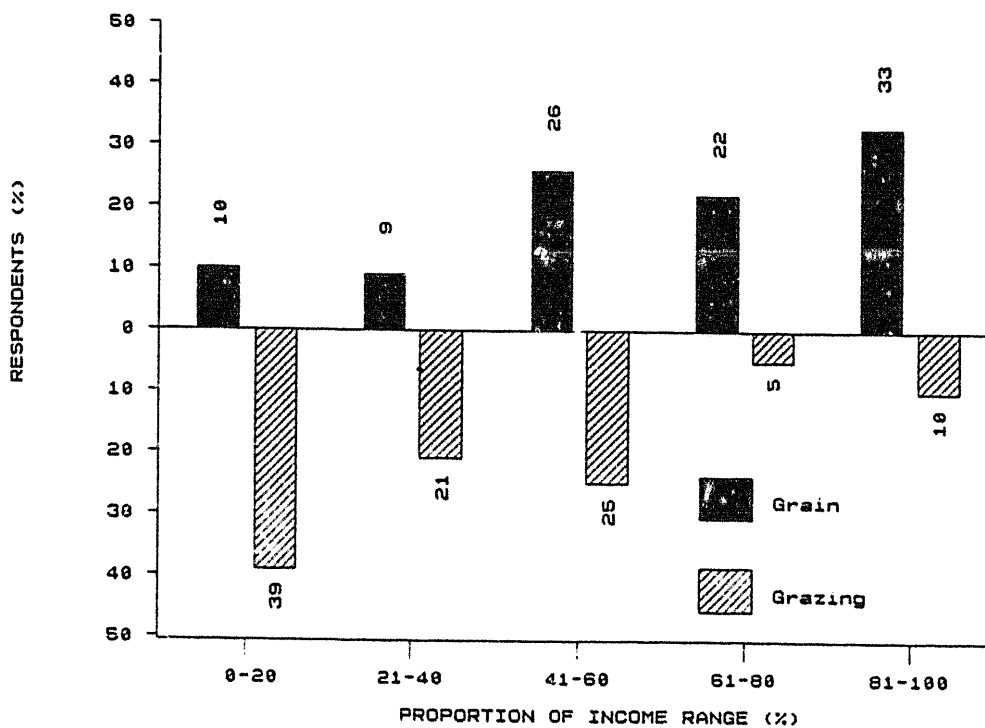


FIGURE 3. AGE OF LAND MANAGERS.

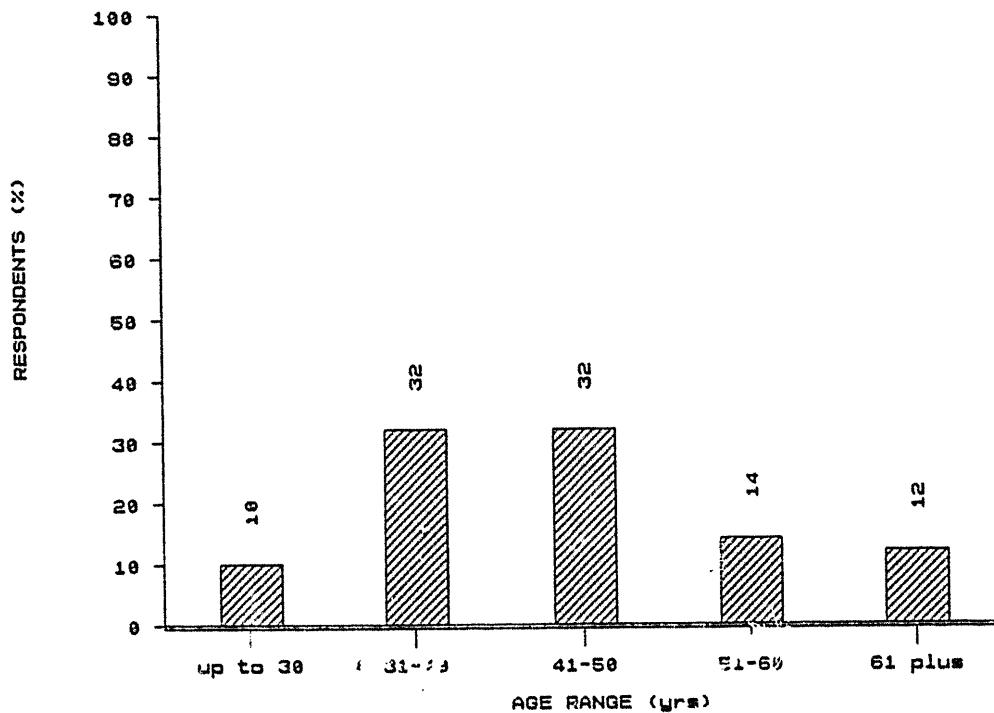
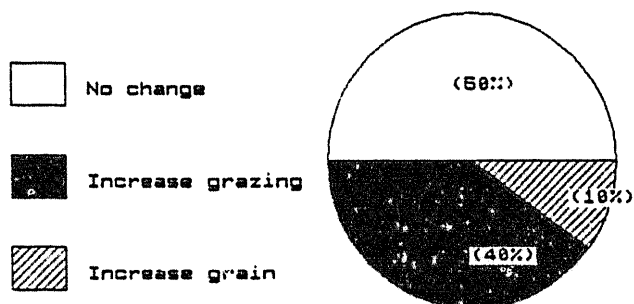


FIGURE 4. LAND USE STABILITY.

- OVER THE LAST 5 YEARS.



- PROPOSALS TO INCREASE GRAZING.

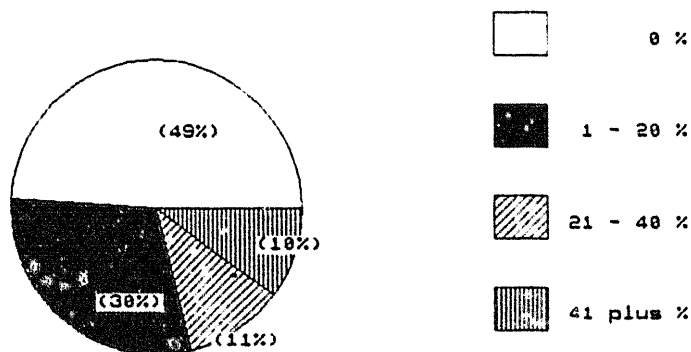


FIGURE 5. IMPROVED PASTURE SPECIES.

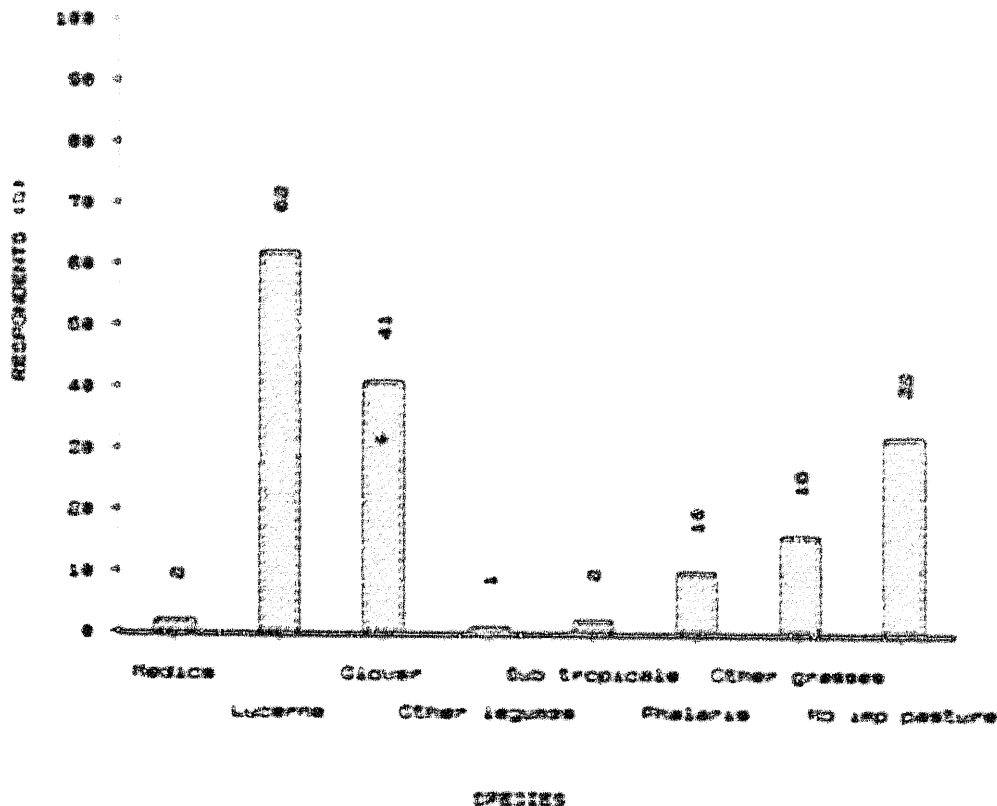


FIGURE 6. IMPROVED PASTURE ESTABLISHMENT METHOD.

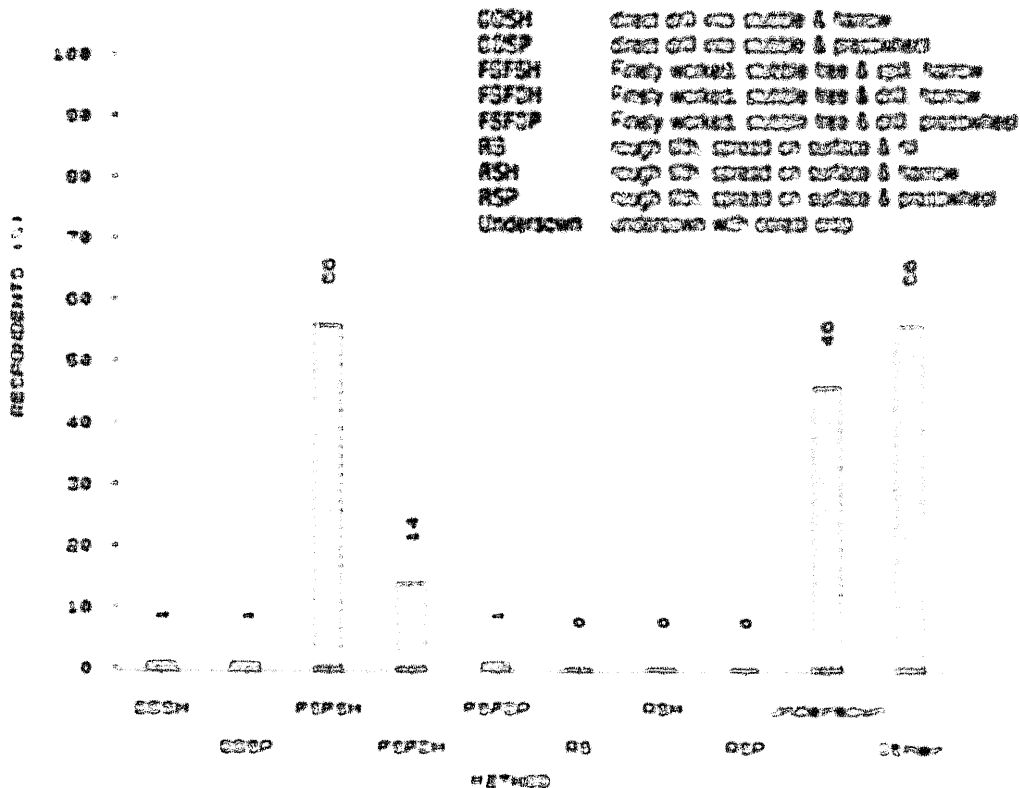


FIGURE 7. HERBICIDE USE.

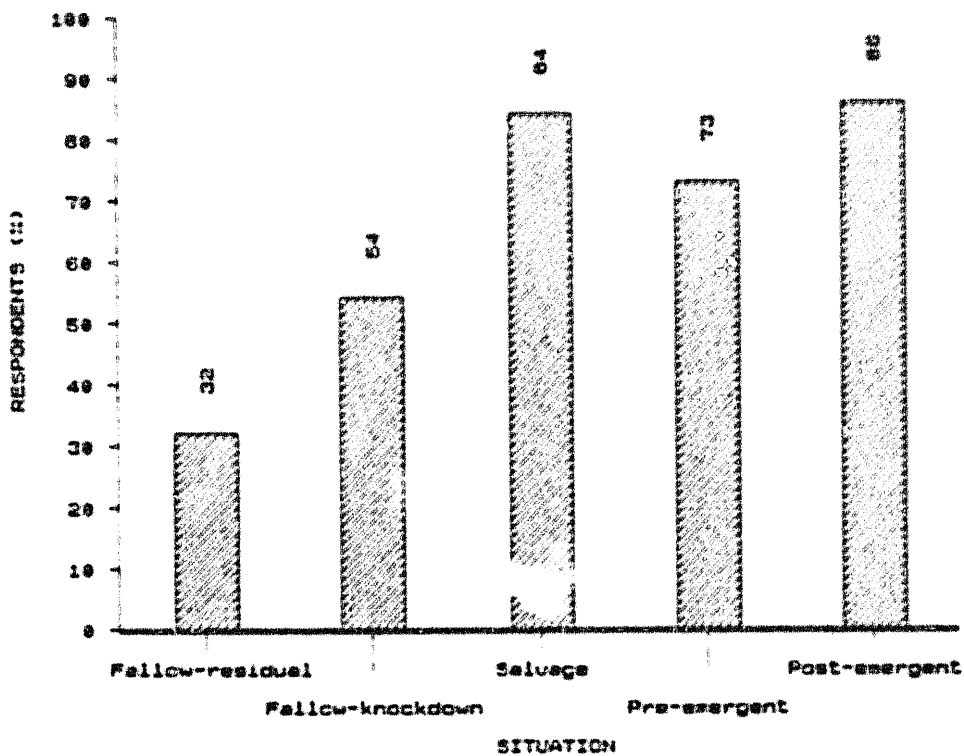


FIGURE 8. COMMON CROP ROTATIONS.

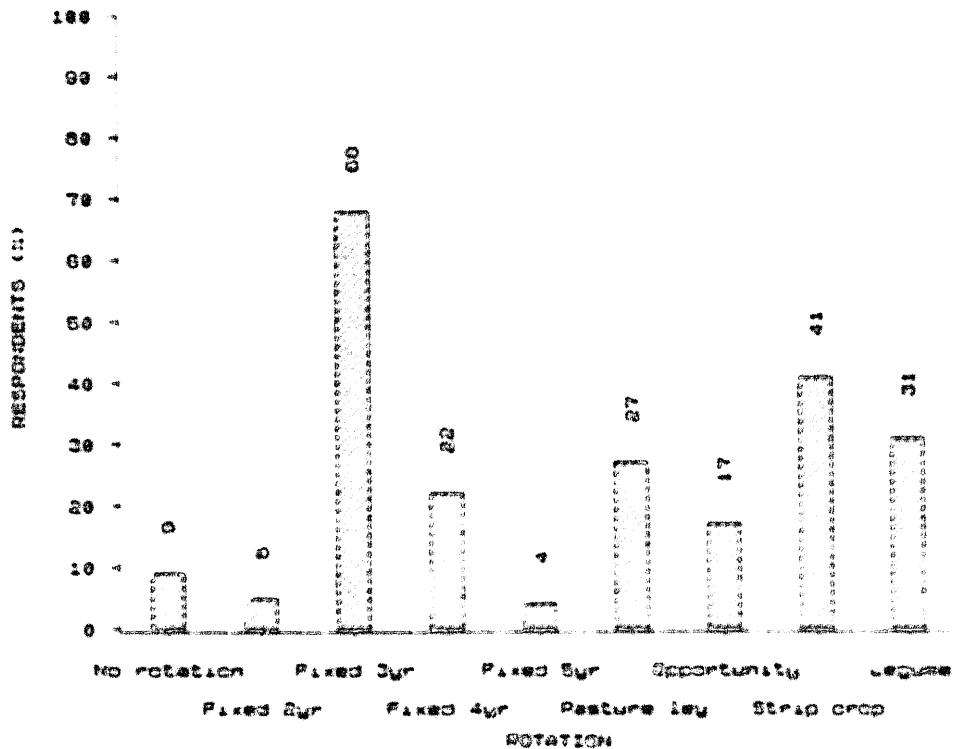


FIGURE 9. SOIL RELATED PRODUCTIVITY DECLINE.

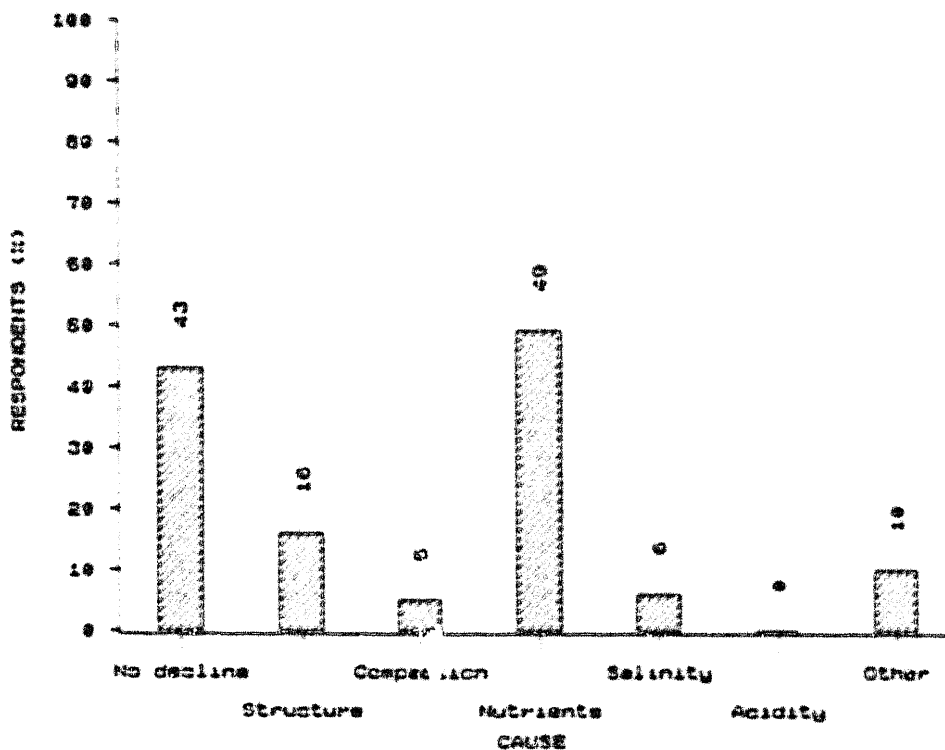


FIGURE 10. FARMING EQUIPMENT OWNED.

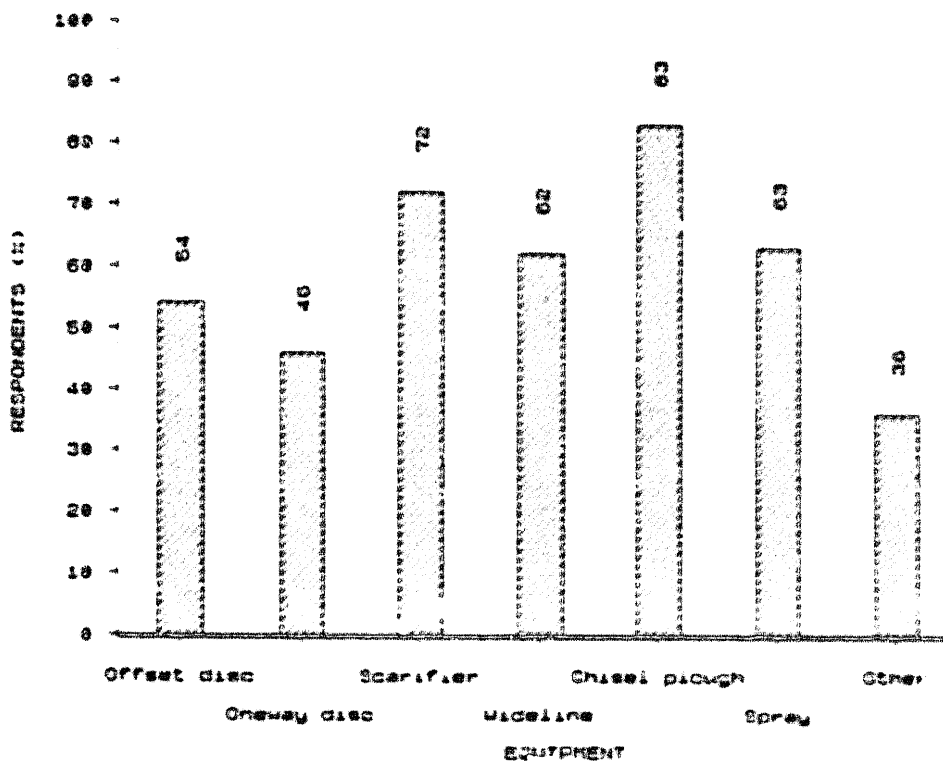


FIGURE 11. SOURCES OF GENERAL INFORMATION.

