



Adoption and adaptation of pre-rains tillage tine (CEEMAT RS8), Yatenga Province, Burkina Faso. A monitoring report

7-22 March

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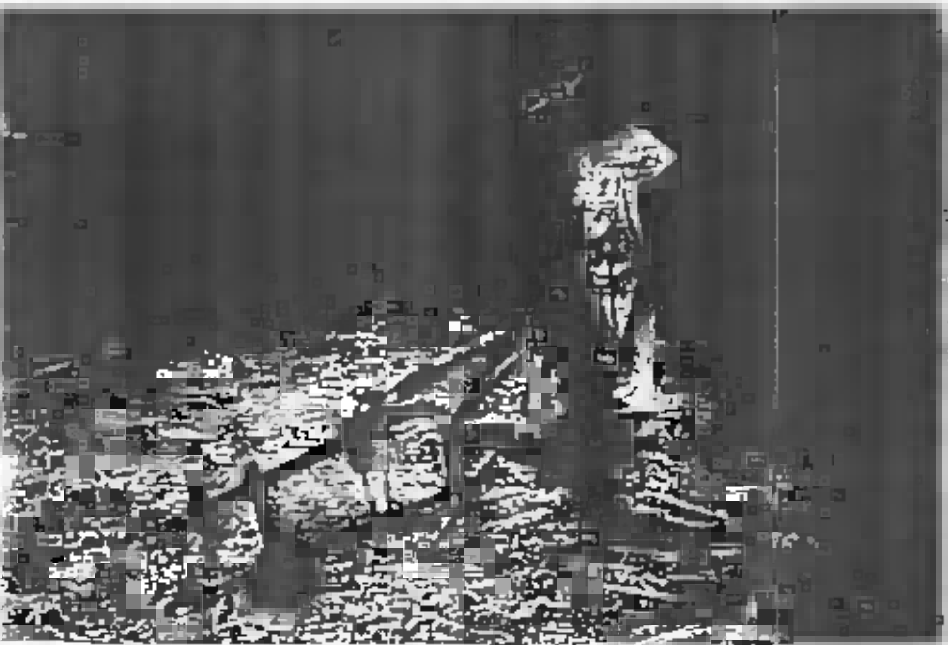
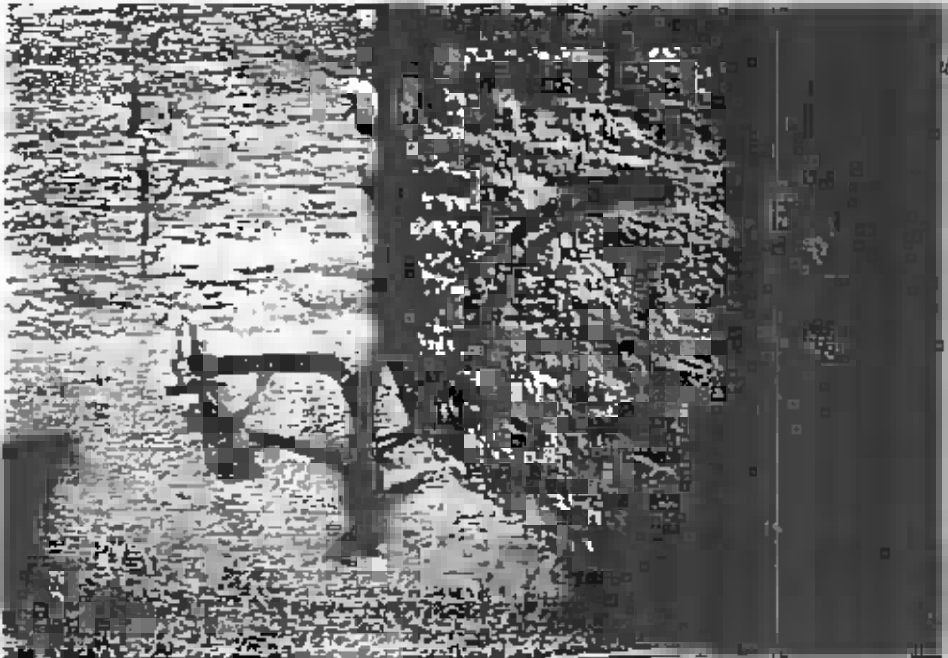
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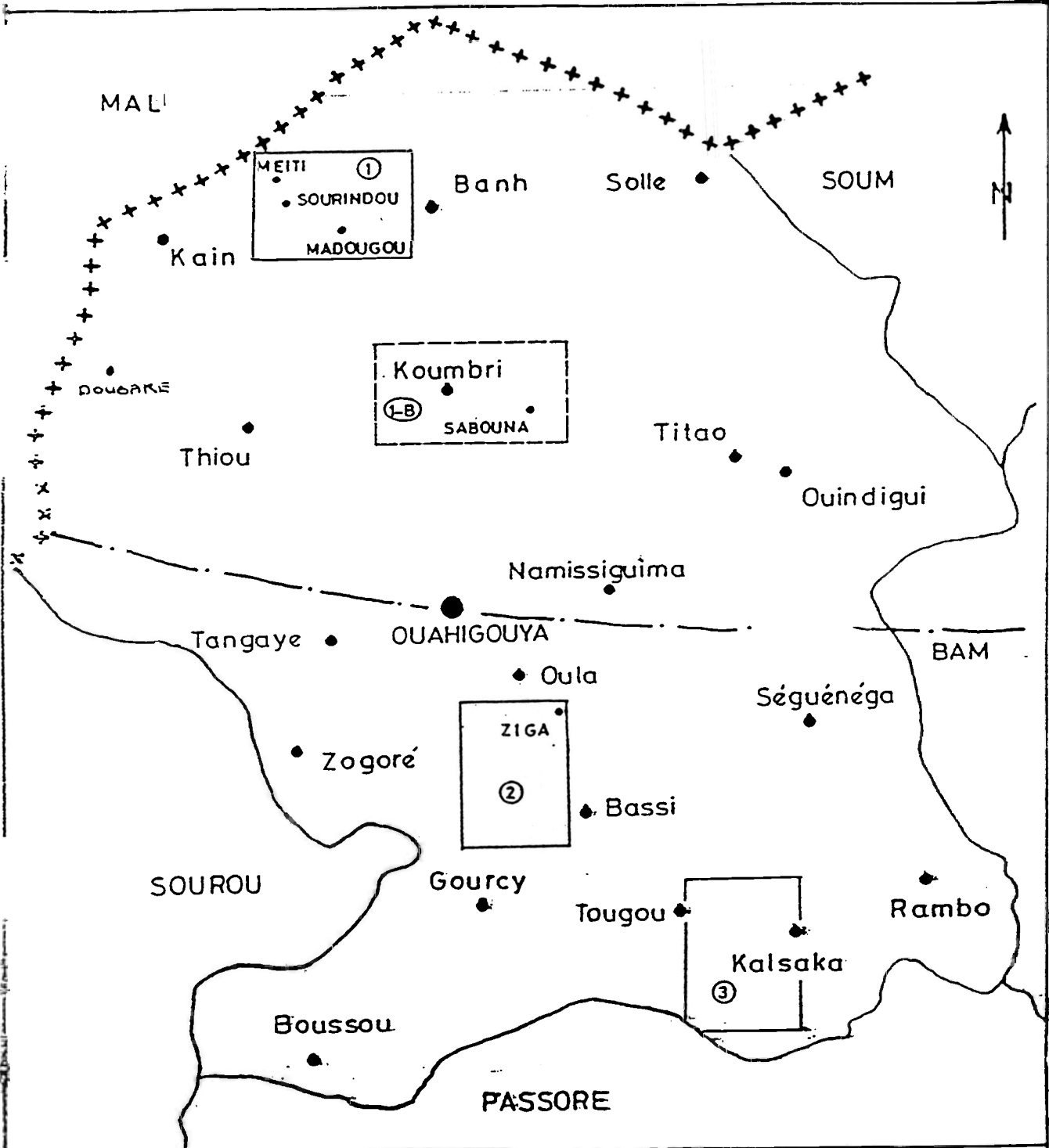
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## ABBREVIATIONS

ANAR	Association Nationale d'Action Rurale
CEEMAT	Centre d'Etudes et d'Expérimentation en Mécanisation Agricole et Technologie Alimentaire. Now known as :
CIRAD-SAR,	le Centre International de Recherches Agronomiques pour le Développement Agro-Alimentaires et Ruraux.
CNCA	Centre Nationale de Credit Agricole
CRPA	Centre Régional de Promotion Agro-pastorale
ESFIMA	Eau, Sol, Fertilisation et Machinisme Agricole, INERA
INERA	Institut National d'Etudes et de Recherche Agronomique
PVNY	Projet Vivrier Nord Yatenga
Six S	Se Servir de la Saison Sèche en Savane et au Sahel .



CARTE DES FUTURES ZONES D'INTERVENTION DE L'EQUIPE IN.E.R.A / RSP DANS LA PROVINCE DU YATENGA (A PARTIR DE L'ANNEE 1993)



++ Limite d'Etat	① Extrême Nord
— Limite de province	ⓁB Centre-Nord (facultative)
- - - Limite de zone phytoclimatique	② Centre Sud
● Chef-lieu de province	③ Extrême Sud
● Chef-lieu de département	• Sites de recherche déjà identifiés
□ Délimitation approximative des futures zones d'intervention	

ECHELLE: 1:800.000

Carte n°4

## TERMS OF REFERENCE

The purpose of the present mission, was to monitor actual use of the CEEMAT RS8 pre-rains tillage tine during the 1993 dry season. The specific objectives of the mission were to:

identify a range of possible uses for the tine

determine the parameters and conditions necessary for these various uses

detail the socio-economic issues in dry season cultivation

prepare a plan for continued monitoring of farmer adoption and adaptation.

This was to be done using the experience of the farmers who were expected to use the tine during the dry season within the three test villages. Consideration was also to be given to working with OXFAM, for wider evaluation of the tine.

## SUMMARY

### INTRODUCTION

1. This report presents the results of a monitoring exercise designed to evaluate the potential of a dry-land tine (see Figure 1) for facilitating crop production in Yatenga Province, Burkina Faso. Part of the exercise involved reviewing events which had occurred since February, 1992 when the tines were first tested with farmers in one village, Ziga. Tines were subsequently placed in 5 villages: Ziga, Madougou and Doubare, two more northerly INERA research sites (Figure 2), and Brève and Noogo, two villages where OXFAM, the UK based non-government organisation, is funding development activities.

### CONCLUSIONS

#### Tine use

2. Eight individual farmers from 3 villages have used the tines since they were left during the 1992/3 dry season. This suggests limited interest in the tine which contrasts with earlier expectations. However, this finding may partly reflect the poor timing of the monitoring exercise which coincided with Muslim fasting, and in Ziga, occurred prior to the start of official dry season farming activities.

3. While the timing of the monitoring visit was not ideal, the 10 tines which had been placed in the 5 villages were not widely accessible. In addition, their mode of presentation, in general, suggested that the tine has limited use, cannot be adapted to a wide variety of ploughs, and is difficult to fabricate. These issues became the major focus of the present visit and are considered to be the most important aspects of the introduction of this new technology.

#### Tine placement and presentation

4. Tines were first introduced into the two new INERA sites, Madougou and Doubare, during the 1992 cropping season, that is after the beginning of the rains. These introductions were made through the implementation of a trial comparing tools and equipment used for different purposes. The trials were introduced by an INERA technician and implemented by an INERA field assistant on land contracted from farmers. Subsequently, during the present dry season, two tines were left in each village following a demonstration by the INERA field assistant. In each of the villages, the tines were presented as having a single end use, the regeneration of degraded land, and the tines were attached to an INERA plough and left with the INERA field assistant hired within the village. In Doubare, the

demonstration was completed using a camel of which there were only two in the village.

5. The tine was first introduced into the two OXFAM villages in March 1993. Again, these introductions involved a demonstration by an INERA technician of tine use for the regeneration of degraded land. The demonstration was laid out like a trial and involved a comparison of tools designed for different end uses. One tine has been left in each of the two villages.

6. In October, in Ziga, the tine was adapted to a local plough (CH9) as agreed during the February, 1992 visit. However, there are a maximum of 8 CH9 ploughs in the village and no attempt has been made to attach the tine to other ploughs. In Doubare where the tine was attached to an INERA plough, one farmer took the initiative to attach the tine to his own plough since he considered the INERA plough to be too heavy.

7. In Ziga, three tines were left with the President of the farmers' associations.

#### Access to draught animals and equipment

8. Emphasis has been placed in this field exercise on assessing who is likely to be able to gain from any benefits the tine may give. Access to draught animal power is the key consideration.

9. In general, the availability of draught animal power in the test villages was more widespread than official figures based on acquisitions of material through formal credit suggest. Emphasis has been placed in previous reports on the need to attach the tine to the houe-manga. The houe-manga is limited in its distribution and while it may be appropriate to ensure that tools can be adapted to this equipment, this is not a major issue.

10. There is considerable borrowing and exchange of both animals and equipment in these villages. Where families are spread between a number of villages, the exchange of equipment takes place at this level.

11. The issue of the access of women to the tine has not been considered beyond the February, 1992 visit.

12. During the present visit, in Ziga, Doubaré and Madougou, some women reported that they themselves used draught animal power which is contrary to what we had been led to expect on our previous visit.

13. The condition of draught animals was perceived by Silsoe to be a potential constraint on late dry season farm



activities and thus on tine use. However, in all five villages visited, draught animals continued to be in good condition. Sales of draught animals were occurring during the present visit. The timing of these sales is linked with the high demand for and hence high price of draught animals immediately prior to the planting season. There was no suggestion that these sales were linked with any expected future change in draught animal condition.

14. Some farmers hire contract labour to construct zaïs. The tine would replace this hired labour.

#### Tine Production

15. All 10 tines which have been placed in the 5 villages were produced in Ziga even though a key objective of the on-farm introductions made in February, 1992 was to link farmers and blacksmiths in the spread of this technology.

16. Although there were no 'trained' blacksmith in Doubaré and Madougou villages, the local blacksmiths repair ploughs and other farm tools and were considered capable of producing tines.

17. There is considerable variability in ploughs available which suggests that both this tine and other attachments need to be widely adaptable. This finding further supports the need to link local blacksmiths and farmers in any future programme.

#### Institutional issues

18. In general, work by INERA staff on this project was additional to an already established work programme. Only the INERA engineer has been directly involved in the on farm activities to date. During the present exercise, two other INERA researchers, the sociologist and agrostologist/veterinarian, participated.

19. One objective of the 1992/3 programme was to establish a relationship with the non-government organisation, OXFAM. OXFAM has been working over a decade in Yatenga Province to develop techniques to address problems of soil erosion and degradation. The OXFAM Ouahigouya representative attended the discussions on the last day in Ouahigouya. The OXFAM representatives based in Ouagadougou were involved in continuous meetings and it was not, therefore, possible to discuss further work with them before my departure from Burkina Faso.

20. In Ziga, an active field extension agent of the CRPA was involved in the February 1992 exercise and played a key role in ensuring farmer participation. While the field agent was provided with one tine which farmers could borrow,

the link between himself and the INERA technician who has been the key field person, has been minimal.

21. One of the Ziga tines was borrowed by the INERA technician for work elsewhere suggesting that the tines were not solely for use in this village.

22. INERA technicians have played the key role in the field tests relating to this tine. Unfortunately, the technician who worked with the Silsoe/NRI team in February 1992 was not the person who completed the subsequent field work. The latter had not received any detailed information about this programme and, therefore, was not aware of any discussions regarding access and ownership of ploughs and tines, the involvement of women, the mode of participation of farmers and blacksmiths and the expected role of research and extension.

### Recommendations

23. During this project year, attempts have been made to assess the potential value of the dry-land tine before it has been effectively introduced into test communities. It is suggested that further work on introduction and testing be completed in locations where the continued presence of a senior researcher can be guaranteed. It is essential that a social scientist is involved in this work.

24. A brief, focused survey of women's involvement in animal traction use would seem to be justified in the test villages in Burkina Faso. The actual use of draught animal power by women has not been widely reported. Such a survey could be completed by students under the supervision of a researcher.

25. Copies of all reports relating to the CEEMAT tine should be sent to INERA and OXFAM. A minimum of 4 copies should be sent to INERA, one for headquarters (ESFIMA), one for the INERA head of the project (Mr Son), one for the farming systems team in Ouahigouya and one for the CRPA, Ouahigouya.

26. With respect to future research on farm tools, it is suggested that all relevant actors should be involved in the programme from the beginning. These include researchers, technicians, farmers and tool producers. A list of all possible actors should be drawn up at the beginning.

### ISSUES TO BE ADDRESSED IN THE IMMEDIATE FUTURE BY INERA

27. Before leaving Ouahigouya, it was agreed with the INERA Farming Systems team that additional work needed to be done to complete the planned programme of tine introductions in

the test villages. These agreements are detailed in Appendix 2.

28. Given the conclusions of the present visit, the main task associated with the continued research on this dry-land tine in Burkina Faso continues to be to monitor use, at least in Ziga village. Prior to my departure, I prepared a brief monitoring schedule to be completed by the extension officer in Ziga (Appendix 3). For the follow up of this information, a further visit is recommended as soon as possible. While it was agreed that the INERA sociologist would attempt to participate in further monitoring of tine access and use, she was unable to discuss this in detail with me before my departure and it was not clear that she would have the time to return to Ziga or to become involved in this work. The following agreements were reached:

tines which have already been placed in the villages should not be removed by INERA staff for use elsewhere

a demonstration of tine attachment to local equipment should be completed in all villages where this has not already been done

in Ziga, all types of ploughs in the village should be assembled and the tine attached to as many as possible. The local blacksmiths and the extension representative (CRPA) should be involved in this exercise

at Doubaré, tine use with oxen should be demonstrated by a farmer

information should be given to farmers in Doubare, Madougou and the two OXFAM villages, about the wider use of the tine

in each of the 5 villages, a local blacksmith should be asked to fabricate a tine which should be tested by a farmer in the presence of the blacksmith

relationships with extension or project staff who live in the village should be maintained since these staff will ultimately be responsible for giving tine information to farmers

## FARMER PARTICIPATION IN THE EVALUATION OF A DRY-LAND TINE

### BACKGROUND

29. In February 1992, an on-farm evaluation of the CEEMAT RS8 tine was initiated following 5 years of station tests and modifications by CEEMAT, Silsoe Research Institute and the national agronomic research institute, INERA, in Burkina Faso. The principle foci of the socio-economic component of this on-farm evaluation required an analysis of farming systems, the identification of critical production constraints and farmer strategies for overcoming these, an assessment of the economic value of earlier land preparation and consequent changes in labour use following tine introduction, the identification of possible adoption constraints by a range of farmers and an assessment of the likely interest of blacksmiths in tine production (Okali, 1992). One other possible limitation on tine use identified by the various researchers involved was the condition of draught animals during the dry season.

30. The results of this evaluation, which took place in only one village in Yatenga Province, Ziga, were generally positive in the sense that the test farmers appeared to appreciate its value, and that tine use did not appear to be associated with any environmental degradation.

31. By its dependence on local material and resources, its relative affordability and simplicity of construction (requiring no special additional equipment over and above what is already used) and use, the tine also appeared to be potentially available to a large proportion of owners of animal traction equipment. In addition, since the tool extended the period over which land preparation could take place, it also appeared to offer the opportunity for non-owners of draught animal power to gain access to the technology through borrowing. Finally, at the time of the survey, February/March, 1992, draught animals were in good condition and, therefore, one of the perceived technology constraints did not appear to be important.

32. While an attempt was made to ensure that the tine was tested in a variety of soils, emphasis was placed on allowing farmers themselves to suggest where and how they might use the tool. In general, the experience suggested that the tine might be used in a variety of circumstances. This fitted with past research and development experience across many technologies which has demonstrated that many items of rural technology should be conceptualised as multi-purpose (and mobile) power units for purposes other than that for which they were designed rather than task-specific pieces of equipment (Samson, 1969; Binswanger, 1978).

33. At the same time, an attempt was made to involve farmers from different parts of the community, farmers in different economic circumstances and a few women, even though there was limited time and opportunity to take these issues fully into consideration. Serious consideration was also given to involving a local blacksmith in the introduction process. This approach fitted with some more recent mechanisation studies which emphasise socio-economic rather than technocratic/ mechanistic issues surrounding rural mechanisation processes (Biggs et al., 1992). These studies emphasise the need to identify the main actors and groups who might gain or lose from different mechanisation strategies and to devise implementation approaches which take these into consideration.

34. In order to pursue these issues further, it was suggested that more information was needed on who has access to draught animal power, especially the extent and terms of borrowing, possible problems in extending access during the dry season and potential for mechanical cultivation of women's personal fields during the dry season. Since it was concluded that women did not handle draught animals, more information was needed about the availability of male labour during the dry season. It was also agreed that more information was needed on draught animal condition throughout the dry season: 1991 was a good crop year in Ziga.

35. While these issues could have been investigated independently of any work with the tine, it was also agreed that what is termed as 'an action research' approach would be appropriate: observations and discussions would revolve around an actual tool under promotion.

36. During the February 1992 tests, while it appeared that the use of the tine required no substantial change in the farming system, various questions such as whether planting could be done directly within the furrows made by the tine, were raised by the farmers. Although some concern was expressed by researchers that these issues needed further station research, it was agreed that some of these issues might be resolved by the farmers themselves. At the same time, it was also noted that farmer concerns would vary depending on the specific sites where the tine was used, actual practice of draught animal power and agronomic practices. It was argued that the specificity of each case again supported an action research approach rather than station-based trials.

37. As a first step in this proposed action research, it was agreed that the tine should be made more accessible by, in the first instance, it being attached to a local tool bar: all station tests and hence the first tests in Ziga had been completed using an adapted tool bar. Secondly, while

the tine appeared to be relatively inexpensive and, therefore, affordable, it was agreed that more had to be done in this first instance to stimulate its use and thus enable more widespread testing. It was agreed that four tines would be made available in the first test village, Ziga, and two other villages were to be included in the research. At the same time, it was agreed that serious consideration needed to be given to the selection of these sites given Ziga's historical involvement in research and development activities, its large size and apparently well organised village groups, all of which characterised Ziga as a unique site (Okali, 1992). It was also emphasised that future farmer participants would be self selected: of the 4 farmer participants selected by INERA for this first exercise, three included the president, the vice-president and the secretary of the largest farmer association in the village. Accordingly, the actual location of the tines in the village was to be determined in discussion with village extension personnel, if resident, and the villagers themselves. Finally, it was understood that the tines would be made by local blacksmiths.

38. In October 1992, therefore, David O'Neill of the Silsoe Research Institute visited INERA to try to ensure wider farmer access to the tine by ensuring its adaptation to a local plough and the strategic placement of a limited number of tines in 3 villages, one of which was Ziga. At this point there was some follow up of the fields where the tine had been tested during February, 1992 and a brief visit made to the two more northerly sites selected by INERA. The OXFAM villages were selected later.

39. The purpose of the present mission, on the other hand, was to monitor actual tine use during the 1993 dry season. The more specific objectives of this continuing work were to:

- identify a range of possible uses for the tine

- determine the parameters and conditions necessary for these various uses

- detail the socio-economic issues in dry season cultivation

- prepare a plan for continued monitoring of farmer adoption and adaptation

- prepare a project memorandum for future collaborative research towards improving crop production in similar zones using draught animal power.

40. This was to be done using the experience of the farmers who were expected to use the tine during the dry season within the three test villages.

41. Further consideration was also to be given to working with OXFAM, for wider evaluation of the tine.

#### METHOD

42. The intention during this brief two week visit (see Programme in Appendix 1) was to concentrate on quantifying actual tine use, recording technical problems encountered through focused interviews with users, and understanding access issues through an analysis of users' social networks. More general discussions of borrowing and exchange of draught animals and equipment were also planned. The programme was to include blacksmiths and farmers in the three sites where tines had been placed. As appears to be always true with brief field visits, the timing was not especially good as the visit coincided with Muslim fasting.

43. As agreed, the INERA farming systems team based at Ouahigouya had selected two additional sites, Madougou and Doubare, in Banh and Kain departments, respectively. Agricultural extension staff are rarely to be found in these two villages. Two tines were placed at each of these sites while four were placed in Ziga, the original on-farm site. Immediately prior to my visit, the ESFIMA technician had also contacted OXFAM for two sites close to Ouahigouya town (Brève and Noogo in Oula and Namissiguima departments respectively). All five sites were visited during this monitoring exercise although this report concentrates on the first three since the work at the OXFAM sites is very recent. The first task at each site was to reconstruct what had actually happened since February 1992 (See list of people interviewed in Appendix 4).

#### TINE INTRODUCTION AND USE IN ZIGA, MADOUGOU, BOUGARE, BREVE AND NOOGO VILLAGES

##### ZIGA:

44. Details of Ziga can be found in the first visit report (Okali, 1992), and below. Ziga is located in Oula Department, is the largest village in Yatenga (population 4,700) and was INERA's main on-farm testing site for at least a decade. While INERA moved to more northerly sites since 1990, it maintained Ziga as a field testing site for individual technologies and plans to intensify its activities in the village in future.

45. In Ziga discussions were held with the 4 farmers who had been directly involved in the tests in February 1992, 2 of the 3 women who participated in the demonstrations given at the end of the tests, three men who had approached the blacksmith to discuss the possibility of making a tine, one person who has actually used the tine this year, one who has

already approached the president of the farmer's association for borrowing a tine, two blacksmiths and two other farmer groups in neighbourhoods of the village not covered by the above persons. The ESFIMA technician participated in some of the Ziga discussions while the extension representative (of the CRPA, Yatenga) participated throughout.

46. As noted above, four tines had been made available in Ziga. One was left with the extension officer while the remaining 3 were left with the President of all the farmers associations. During the October visit of David O'Neill, an attachment had been made for a plough described as the CH9. The distribution of these ploughs in Ziga became a key focus of the discussions during the present visit.

47. Unfortunately, dry season farming activities had not started in Ziga by the time of this visit. In Ziga, the onset of farming activities are formally announced by the President of the farmers' associations. While this does not necessarily limit individual farmer initiative, in fact, since the visit also coincided with Muslim fasting, little activity was to be seen. Nevertheless, one farmer had actually used a tine by the time I arrived and the President of the farmers' association had used the tine at the end of the 1992 cropping season.

#### DOUBARE and MADOUGOU:

48. The INERA farming systems team based in Ouahigouya has been concentrating its activities in the northern departments of Yatenga, at Boubare and Madougou. Here there are extensive areas of degraded soils and hence these sites seemed more appropriate than Ziga for the tine. However, information suggested that there were far lower levels of draught animal power equipment available at these sites than in central and southern Yatenga villages. Information on these two northern villages was extracted from INERA reports (Ogier et al. 1992;1993) and the field visits were made with two of the systems team members. Meetings were held with all the individuals who had been involved in the 1992 trials and anyone involved in using the tine this year. In addition, discussions were held with a group of about 15 male and 3 women, farmers in Doubaré, whom we met sheltering from the sun under an awning. Loaning and borrowing of equipment was discussed with 2 other individuals in this same village. A group of blacksmiths was visited briefly in each village and all the plots/fields where the tine had already been used this year were seen. The visits to these villages was brief because the work programme of the INERA systems team was under review.

49. The tine was first introduced into Doubaré and Madougou through a trial implemented in June 1992. Details of the trial protocol are given in O'Neill (1993). The objective



of the trial was to compare different land preparation tools and the impact of these on subsequent plant development. The tools included the CEEMAT tine (land was prepared as for zaïs with subsequent first weeding using a houe manga and a second weeding using a butteur), the CRPA tine (land preparation as for zaïs using the same weeding equipment as for the CEEMAT tine), the houe manga (for customary land ploughing and using the same weeding equipment) and 'traditional' techniques with no land preparation. Locally hired INERA field assistants in each of the two villages were asked to identify three people with land with compact soil who were willing to participate in the trials. Apart from the manually prepared plots, the INERA technician did the actual work with the tools. Further details for each of the sites are given below.

### Doubaré

50. Doubaré village has a population of 782 divided amongst 8 quarters with 82 production units. The village was established in the early 20th century (1914), initially by immigrants from Mali and Central Yatenga, subsequently by Peulh. Doubaré is a border settlement and as such has continuing close links with Mali. However, migration south, both seasonally and long term, is part of the livelihood strategy of most households. This movement is to Ghana and Ivory Coast and to local gold mining sites. As in other Yatenga villages, the community is divided into a number of groups of which 12 were mentioned. Only one is a traditional group.

51. Degraded soils (zipélé) are described as extensive and hence the practice of zaïs is widespread. Zaïs were under construction during the present visit which suggests there is no customary limitation on dry season activities as in Ziga. As in Ziga, millet is the common staple but sorghum is the most popular, preferred crop. While the INERA diagnostic survey indicated that commercial and non-agricultural activities are not well developed in Doubare, some households produce a surplus and sorghum is exported: 200 sacks have already been exported from this village since the November harvest and more is being bagged. There appears to be considerable exchange of animal traction equipment between Doubare and neighbouring villages in Mali.

52. As already noted, the tine was first used in Doubaré in 1992 in a formal trial. The local INERA field assistant reported that few people had land available to be used for the trial since it was being implemented in June by which time the cropping season had already started. He, therefore, had little choice of land but three men agreed to participate, including his own brother who is one of two people in the village with a camel which can be used for animal traction. All three men came from the same quarter of

the village. One of the three has no animal traction equipment or traction animals of his own but he had participated in an INERA variety trial in 1991.

53. The trials were completed using the camel belonging to the brother of the field assistant. Two of the three trials were successful in the sense that there was a harvest. Nevertheless, all three participants were apparently convinced that the CEEMAT tine 'performed best'. The assistant himself harvested one of the two 'successful' plots.

54. Like in Ziga, following the tests, 2 CEEMAT tines were left in the village, in this case with the INERA assistant. The tine was attached to an INERA plough. During the dry season, the assistant himself demonstrated the use of the tine for making zaïs. It was not clear how many people watched and commented on this work.

55. To date this dry season 3 people have used the tine: the assistant himself, his brother and the second man with animal traction equipment (but not a camel) who completed the June 1992 test. All three men used the tine for making zaïs on 'zipélé' soil. Five other people, including the one participant from last year who has no plough of his own, have expressed an interest in using the tine. These potential participants all come from different quarters of the village.

Madougou (Ogier et al., 1991

56. Madougou village, located in Bahn Department, has a population of 1,000. Like Doubare, it was established in the twentieth century and has expanded considerably since the 1930s. The population is mixed including Rimaibé, Mossi (with Fulsé assimilés) and Peuhl. Again, there are a number of village groups established under the auspices of different agencies at different periods. These agencies include the Six S which has established a cereal bank and introduced a cereal grinder. Most of the groups were created in the 1980's. All collective activities undertaken by the various groups are supported by food for work.

57. Two key issues are raised in the INERA farming systems document: a reduction in specialisation between livestock and crop production and land pressure leading to conflicts. Reference is made to the fact that Peulh are especially interested in milk production, from goats and cattle and there has been some introduction by extension (the CRPA) of legumes - 'la dolique' - to be grown for fodder. Land pressure is discussed in a number of ways.

58. It is suggested that the continued control of land by male family heads discourages young people and that the

latest group formed, of young people, might reflect dissatisfaction with this situation. Especially critical land problems were indicated for particular groups of people whose land is now degraded but for whom further expansion is not possible (although no detail is given in the documentation of precisely which groups are involved). For these groups, the only solution would seem to be the regeneration of this land which is why the tine appeared to be especially interesting for the village. The only alternative to soil regeneration is the expansion of production on sandy soil distant from the village.

59. Although there is continued reference in the document to potential land conflict between the 3 ethnic groups, no actual conflict appeared to have occurred since 2 cases 40 years ago. However, the recent work of the farming systems team highlights the issue of increasing conflict between herding and agriculture.

60. Like other villages in the sub-Sahel for which there are data, long term migration out of the area by household members forms part of the overall strategy for household survival: almost all households have long term migrants in the Ivory Coast. Short term migration, on the contrary, has decreased with the construction of a local gold mine in 1986.

61. Discussions about the various tests completed at Madougou were somewhat confused which may reflect the fact that there are various INERA activities ongoing at these sites and not all activities are jointly discussed. The local technician was asked to locate three people to participate in the June trials. In fact only one person volunteered and hence only one site was used. Again this was a degraded area. As noted above, the test included the use of tines for preparing zaï's. The involvement of the farmer appeared to have been minimal and he was unable to provide information on precisely what the work involved. He claimed not to have visited the plot during the season. Although the story was somewhat confused, it appeared as though the CEEMAT tine treatment was completed using a camel which was rented from another village. Oxen were used for the other treatments. The Madougou technician hired labour to do the manual work while he harvested the crop.

62. When the two CEEMAT tines were placed in the village later in the year, the technician held a meeting and demonstrated how the tine should be used for making zaï's. One tine was attached to an INERA plough while the second was attached by one of the four demonstration participants to his own plough. He noted that the INERA plough was too heavy for his animals.

63. Four people watched the demonstration, including the brother of the technician. Four people have already used the tine this dry season including one man who did not participate in the demonstration. The field assistant and his brother actually borrowed the local plough with the tine attached for work on their own field.

#### THE OXFAM VILLAGES: Brève and Noogo

64. Brève, with a population almost 2,000 lies 17 km South West of Ouahigouya in Oula Department. OXFAM started work in the village about 5-6 years ago. No documentation on the village was reviewed although OXFAM has completed a participatory rural appraisal. Only two of the four quarters in the village is currently participating in the OXFAM programme, the other two decided that they were unable to meet one of the participating requirements: animal confinement. We completed an inventory of animal traction equipment in the two quarters comprising 6 concessions: 9 ploughs, 1 houe manga and 2 carts.

65. This village and farmer participant was selected by OXFAM one week prior to my visit. Again the INERA technician laid out a demonstration, in plots, as was done for the earlier trial. The demonstration focused on the use of the tine for constructing zaïs. The tine was attached to the personal plough of the participant. The technician attached the tine to the plough, completed all the mechanical operations leaving the farmer to complete the zaïs manually. Apparently a number of people collected that day to watched the operation.

66. The second OXFAM selected village, Noogo, lies 15 km to the east of Ouahigouya in Namissiguima Department. It has a population of 1,500, all Mossi. OXFAM started working in the village 7 years ago. Not everyone participates and there are other organisations working here. Again, no reference was made to documentation about the village and discussions were limited to the one man selected to participate with INERA.

67. The tine was introduced in the same way as in Brève. The concession involved is the first to be reached as you enter the village. We are told that on the day the demonstration took place, 10 people came although no women. Again, the demonstration was of zaïs. In this quarter we are informed that there are 11 concessions of which 4 have ox ploughs and 5 have oxen.

## POTENTIAL FUTURE TINE USE

Expressed interest in and knowledge about the tine

### ZIGA:

68. Apart from people who had actually used the tine, discussions about the tine in general and peoples' knowledge about it were limited to Ziga. Discussions were held in at least one concession in each quarter of the village.

69. In general, everyone recollected the February 1992 tests, some individuals knew that tines had been left in the village, less knew precisely where they were and even less knew to which plough the tines could actually be attached. Why do many people seem to be poorly informed?

70. The issue of communication is complex. In Ziga, the President of the farmers' groups says that meetings are called every two weeks and it was at one of these that the announcement about the tines was made. Thus the President, (holding 3 tines) says that the people who did not know the tines were with him did not attend the meeting. However, meetings are rarely attended by everyone, for various practical reasons (including the fact that the President's quarter is distant from the main village) but also because people have different interests: a village is not a single unified community. At the same time, village meetings are held in a rather classic fashion with no concern given to who is present, and information is often poorly communicated. Meetings which are held specifically to announce events etc. come as a surprise (pointed out by 2 of our informants) and timing is not always convenient. Certainly women are not specifically invited and so do not, in general, attend (1993: Traore). When the tine was actually attached to the CH9 plough, only 4 people were reported to have attended the small demonstration given.

71. There is also no permanent INERA senior staff person based in Ouahigouya with responsibility for this particular project. The INERA technician who had carried out the work in the 4 new sites had been given very little information. Unfortunately, INERA did not maintain a close link with the resident extension staff in Ziga, even though he had actively participated in 1992. At that time and during the present visit, it was noted that he was an important source of information for many people.

72. However, not even the people who knew where the tines were and had used it in February 1992 had used them by the time I arrived. These people were closely linked with the President and hence had not started any dry season activities. One (the son of the President) had approached the blacksmith about possible tine fabrication.

73. An important issue is the distribution of the CH9 plough to which the tine was attached in October 1992 and we discussed the distribution of this plough at length. The general conclusion was that while the tine was attached to this particular plough, it could equally well have been attached to some other plough of similar design. This was later confirmed during the visits to the other 4 villages. Meanwhile, there are between 7 to 10 CH9 ploughs in Ziga and as far as we were able to determine, at least 2 quarters had none.

#### Women and tine use:

74. In Ziga, discussions were held with the women who had participated in the 1992 demonstration about information they might have shared with their spouses, the women's group and their access to any animal traction equipment in the concession. Apparently little discussion took place within these concessions after the demonstration. The women expressed the view that they could have more readily profited if their husbands had been involved in the tests: 'there is clearly something for us if there is something for the men'. The women also did not discuss the tine with the women's group which also farms a communal field and purchased an ox. The group usually negotiates with the men for a second ox and plough.

75. Everyone agreed that women do not own animal traction equipment. Some insisted that women do not even own donkeys. Only one of the three women came from a house with animal traction equipment. In one of the latter cases, we were told that this was borrowed last year and her own groundnut field was ploughed along with the other family and personal fields. The women did not appear to be aware that 4 tines had been left in the village.

#### DOUBARE:

76. In Doubaré, a major problem of access was created by the tine being introduced as a tool to be used with a camel. As noted above, there were only 2 camels in the village and people were being asked to pay 5,000CFA/day for loan of the camel. Both the tine and the plough was free since both were provided by INERA. No-one appeared to have considered using the tine with oxen and the possibility of attaching the tine to any of the other equipment already in the village had not been considered. We were actually asked by some farmers if the INERA plough could be purchased in Mali.

77. Meanwhile, five farmers have expressed an interest in using the tine this dry season. Three who have their own animals had already initiated activities this year. The

remaining two have no animals. Both have had previous links with INERA and one of them participated in the demonstration in June.

78. Women have not been involved in any discussions about the tine.

#### **MADOUGOU:**

79. As noted, the main potential access problem in Madougou was the introduction of an INERA plough. Since this problem had already been addressed by one farmer by the time I arrived there was no reason to believe that further adaptation would not be done. However, all the people involved in the tine demonstration and use to date were located in one part of the village. No specific attempt has been made in this village to involve women in any discussion about the tine.

#### **Accessibility and use of draught animal power**

80. While the tine has been introduced into these 5 villages attached to a specific plough, what happened in Madougou suggests that ultimate use, if people are really interested, will depend on the availability of various types of ploughs, and oxen. Everyone agreed that dry season work of this nature would be outside the capacity of a donkey.

81. Information on the availability of animal traction equipment in each of the villages has already been presented. Discussions were held in Ziga, Doubaré and Madougou about the extent of exchange and borrowing of equipment and animals and some additional information was put together on the availability of animal traction equipment. Because different units are used in calculations from different sources and official figures provided by the CRPA only refer to equipment distributed with CNCA loans, the information can only be regarded as indicative.

#### **ZIGA:**

82. Two independent sources of information were located on the distribution of animal traction equipment in Ziga. The CRPA for North Yatenga estimates that 30% of households practice animal traction. Their records provide the following figures: 50 carts, 45 donkey ploughs, 180 ox ploughs, 120 houe manga. J. Ogier of the INERA farming systems team in Ouahigouya (Appendix 3) provides alternative and smaller numbers (Appendix 5): 107 production units have some equipment (possibly a cart), only 76 houe manga and 48 ploughs were recorded. As noted in Okali (1992), Ziga is a particularly well equipped village: in the CRTA tables it is recorded as having more equipment than any other village in the Department although because of its size (Ziga is the

largest village in the Department) the percentage of households 'equipped' is smaller than in a few other villages. We did not estimate the number of ploughs etc which have been produced in the village. This equipment would be excluded from the CRPA figures.

83. In Ziga, everyone interviewed agreed that there is a lot of borrowing and exchange of equipment and animals. Since both animals and equipment are bought and sold as necessary, people are frequently without one or the other and depend on family and friends ('It depends on the understanding between people') for completing the necessary work. Within concessions there is widespread borrowing. Women borrow from their spouses, family and friends for ploughing their groundnut fields 'since these must by all means be ploughed'. In cases where cash payments are made, we were given a price of 500F/CFA per day for a plough and 800F/CFA/hour for animals during the cropping season although informants indicated that it was rare for tools to be loaned during this period. At the same time, however, we were also informed that if someone asks to borrow, it is difficult to refuse. This can be done by increasing the price beyond the borrower's means.

#### **DOUBARE:**

84. For Doubaré, the following figures are given: 65 cattle (traction animals were not considered separately), 34 donkeys, 1 camel and 1 horse, 644 sheep and goats (INERA information). In 1991, 19 carts, 8 donkey ploughs, 1 ox plough and 1 houe-manga were recorded by the Northern CRPA and only 4% households were estimated to use draught animal power.

85. As noted already, in this village, there are importations of equipment from Mali including what the farmers referred to as 'artisanal ploughs'. Mali is a recent source of traction equipment: importations appears to have started about four years ago. Overall, the level of mechanisation in Doubaré would appear to be relatively high for northern Yatenga. A rapid count using quarters and concessions as the census frame rather than individual production units, gave 25 ploughs which suggests that something like 20% of production units had some equipment.

86. Fifteen of the 25 ploughs were reported to have originated in Mali. The 25 include a wide range, new and second hand, both factory produced and 'artisanal' and large (for oxen) and small (for donkeys). The cheapest price reportedly paid was 15,000F/CFA. Another factory made product from Mali was priced at 17,500F/CFA. The houe-manga (also referred to as the 'charrue des blancs') is also imported from Mali although there was only one in the



village). We were also told that equipment is moved to and from Mali, according to family needs.

87. Clearly not everyone has equipment and some people have more than one piece: the INERA assistant's brother has 3 ploughs, 2 for use with his camel (which can also be used with oxen) and one which can be used with a donkey. However, as in Ziga, actual use of draught animal power in Doubaré is likely to be much greater than is suggested by ownership figures. Borrowing and loans of equipment are common: one of the men with no equipment who has expressed an interest in using the tine this year borrowed 2 pairs of oxen, equipment and the labour last year for his own farming (most people loan both the labour and the animals and animals were reported to be loaned at 3,000/FCFA/pair/day). He observed that the person who loaned him this equipment had three ploughs, 2 for donkeys one to be used with oxen. Further discussions with the lender revealed that he loaned to 10 farmers during 1992. Certainly, not everyone borrows: the second declared potential tine user with no equipment did not borrow equipment to complete his work last year. As far as we were able to ascertain, exchange not involving cash payment was less common in this village than in Ziga.

88. It was in Doubaré that discussions about the actual handling of equipment by women was first raised during this visit. Women independently produce sesame, groundnut and sorrel and had been reported, as for elsewhere in the zone, to seek assistance from others for their ploughing needs (ploughing was the only activity raised). However, three women noted that they work with animal traction equipment themselves and other people in the village agreed that this was true. Subsequent discussions in Madougou and Ziga confirmed that this did occur although we were not able to establish whether this was only true under some specific circumstances.

#### **MADOUGOU:**

89. The Northern CRPA provides the following information on agricultural machinery for madougou: 12 carts, 2 donkey and 6 ox ploughs. Thus, it is estimated that 5% of production units ('ménages') use animal traction. As is the case for Doubare, the information on livestock in the INERA document does not distinguish between animals used for animal traction and others and while there were 30 donkeys in the village, these were not mentioned because they were not considered important. During the visit, using the quarters as the sampling frame, we calculated that there were 33 oxen used or available for animal traction. One person was said to use a donkey. A total of 13 ploughs were counted, of which at least 2 appeared to be suitable for use with the tine. No houe manga was in the village. Information

provided by J. Ogier (Appendix 5)) for two other northern villages would appear to support these levels.

#### TINE ADOPTION AND THE ROLE OF BLACKSMITHS

90. Since the on farm work was initiated early in 1992, there has been some feeling on the part of officials that blacksmiths will not engage in the production of a particular tool unless the demand is sufficient. However, blacksmiths do complete individual tasks, on demand: repairs of equipment, fabrication of spare parts and construction of ploughs. They also make tools in expectation of demand, including ploughs which are expensive items: an ox plough is sold at 32,500 and a donkey plough at 25,000F/CFA.

#### ZIGA:

91. In Ziga, With Haruna Belem, the 'trained' (trained to make ploughs) Ziga blacksmith who has made all the tines to date, we discussed work which he had on hand. He was making a donkey plough when we visited and has orders for 2 others. He did not receive an advance for the ploughs and purchased the metal using money earned from earlier jobs. As for the houe-manga (of which there are a number in Ziga), he says that the Ziga demand is only for parts, suggesting little new demand for the houe-manga itself. In 1992, he made 6 donkey ploughs, although not all for Ziga. While the objective of the national training programme for blacksmiths was to make provision for tool repairs and fabrication for the villages where the blacksmiths are installed, demand is not restricted to these villages and people go where they want for tools and repairs. People from other villages can and do come to Ziga: only 1 of the 6 1992 ploughs was for Ziga. One request came from a village where there is a 'trained' blacksmith (Bogoré). The other orders came from Roaba, Pela and Bougounam villages and the INERA technician who ordered on behalf of someone else. Again, Haruna made no houe-manga in 1992 whereas in 1991 he made 2 and 4 donkey ploughs. We received similar information from Belem Mahdi, the blacksmith in Boukere village.

92. As in 1992, we discussed again the issue of tasks which 'trained' blacksmiths are not equipped to do and the problems that this creates. Haruna emphasized that he can make holes in tools himself but he has to travel to Ouahigouya for soldering jobs. Since he travels regularly to Ouahigouya this does not present any problem.

#### DOUBARE and MADOUGOU:

93. Local blacksmiths have not been involved in this programme. The tines left by INERA in the village were all produced in Ziga by Haruna. None of the blacksmiths in this village have been trained in modern plough production

although there is a trained blacksmith in a nearby village (towards Thiou which lies 7km from Doubaré). The blacksmiths here can make small repairs to ploughs and are able to make small parts, including tines. From our brief discussion with them, this work appeared to be minimal since they did not seem to have any idea of how many ploughs there were to be serviced in the village. When we visited, the blacksmiths were making attachments for bicycles of which there are many in the village. In Madougou on the other hand, the blacksmiths interviewed were situated in the same quarter where the tines had been placed and were being used and they reported that they had already mended 6 ploughs this year.

#### CHANGING PERSPECTIVES IN TECHNOLOGY DEVELOPMENT

94. The initial approach used to introduce this tine into Ziga was an attempt to change the context of external introductions of new ideas and practices by research in this village. Ziga has been used as a test site for new ideas and practices originating from research over many years. Technology has always been tested within the framework of formal trials implemented on land loaned to the research institute. Farmer participation was minimal. There is no evidence that anyone other than researchers were considered to have any contribution to make to technology development. Most technology was considered to be 'finished' by the time it reached the farm gate. Previous on-farm research has also tended to focus on a small group of influential producers and little attention has been given to wider issues beyond crop yields.

95. As Gass and Biggs (1992) note, '... the diffusion of agricultural technologies ...[is] not simply a matter of peasant demand, research centre supply and issues of adoption and non-adoption' (Gass & Biggs, 1992). In this instance, therefore, there was an attempt to use the knowledge and adaptive skills of people other than researchers: it was assumed by at least one researcher participant (C. Okali) that the technology was not 'finished'. These other sources of innovation included local equipment producers and equipment users. It was also assumed that the tine might have multiple end uses or be suitable for use in a variety of circumstances. This assumption follows the observations of Samson (1969) and Binswanger (1978) that many items of rural technology are used as multi-purpose (and mobile) power units for purposes other than that for which they were designed rather than task-specific pieces of equipment. New technology should be conceptualised in the same way.

96. Given this approach, the main challenge of the research was to develop a strategy for evaluation which allowed for flexibility and choice on the part of equipment producers

and end users. Since research also wished to assess real interest in the tine, an approach had to be used which did not involve providing large numbers of tines, free of charge. Thus, users had to be given some access to tines and a link between blacksmiths and producers had to be established. The strategy finally planned involved giving access to a small number of tines which could be attached to local tool bars. The tines were made locally and the adaptation was completed with the participation of local blacksmiths.

97. Finally, tine access was considered more broadly than is suggested in much of the documentation on draught animal power in the Yatenga area. Particular attention was to be placed on monitoring actual use by non owners of equipment and/or animals, and in particular, by women. This approach was suggested by the fact that the tool is relatively inexpensive and dry season farm activities potentially extend the use of draught animals at a time when they are not in great demand.

98. An approach which stresses the variability in needs and possibilities and therefore a range of options rather than single solutions for universal problems, is timely. Much of the earlier analysis of animal traction in Yatenga and in Burkina Faso as a whole has been completed within a framework of the notion of a 'mechanisation ladder' (meaning that certain agricultural or rural operations are mechanised before others). More recently this view appears to be changing and there is some acceptance of the fact that distribution and use of this technology is likely to vary from one location to another depending on the specific social and socio-cultural conditions pertaining in the locality. These include the type of processes involved in its initial generation and the degree of institutional iteration that took place (Basant, 1987). Hence in some locations in Yatenga the houe-manga is the dominant tool available while elsewhere it is an ox plough.

99. While the initial terms of reference for the social scientist involved in this work suggested that the key factors affecting decisions to test or use equipment would be economic, other factors were considered to be more important. From this monitoring exercise, it has been suggested that at least initially, the level of interest in a new technology is determined to a large extent by the way in which technology is introduced, how the information is communicated and amongst whom the information is distributed. These factors can be manipulated by the institutions and organisations involved in on-farm research and should be seriously considered in work plans.

100. In a recently published evaluation of case studies of participatory technology development, van der Blik and van

Veldhuizen (1993) list three points of particular relevance for planning participatory programmes:

planning should focus especially on the process of interaction, between programme, target group and others instead of on narrowly defined activities [eg. trials]

the process requires sufficient flexibility to adjust the nature and the pace of activities according to what the target group requires and assimilates

as early as possible attempts should be made to bring the target group into the planning discussion.

101. They also highlight the importance of clarifying early on who will do what, and as far as possible, identifying the reasons for participation at all since this will ultimately determine what people are willing to do.

102. With respect to the incorporation of women in technology development they observe that many programmes work with women's groups rather than with individuals. Several writers even suggest that it is culturally more acceptable to approach a group rather than individual women. They also note the need to sensitize staff to make them aware that women do not automatically become beneficiaries of a new technology.

103. In completing an evaluation of this kind of programme, the following list provides an example of the kind of issues to be addressed rather than simply 'Does the tool work? Is it economic to produce? How many people will use it?'

- \* The extent to which the programme influenced the communities' technical capability
- \* The extent of use of local resources and local knowledge
- \* Changing work patterns
- \* Income generation for whom
- \* Environmental implications
- Gender implications
- \* Changes in balance of power: access to and control of resources

## CHECKLIST OF ISSUES TO BE ADDRESSED IN FUTURE MONITORING

104. A simple checklist of 'non-technical' issues to be addressed for future monitoring of the dry-land tine was drawn up following this field experience. The checklist will need to be adapted for each particular case or situation under examination but it can hopefully serve as a guideline for future planning of exercises relating to rural mechanisation of this nature.

### Access issues:

Is there sharing/exchange of animal traction equipment (tools and animals) at the level of concessions (households /compounds) and between concessions etc? Can an estimate of total access be made using this information?

What is the potential significance of a piece of equipment like the tine, for improving incomes of owners of animal traction equipment?

What is the potential significance of a piece of equipment like the tine, for improving incomes of borrowers of animal traction equipment? Is it possible to make any plans to ensure access by groups who do not own animals and/or equipment?

If the tine is especially useful for bringing degraded land back into production, who stands to gain and lose from its introduction? (who has rights to this land?)

Do women have their own individual fields or are they limited to plots within fields of spouses and other men? Are there any particular gains for women if they can have access to dry season land preparation? (Do they know sufficiently far in advance which are their fields and plots etc?)

### Labour issues:

Does the tine allow substitution for hired labour? Who are the labourers?

Does the tine release a particular category of labour?

Is the tine likely to increase labour for particular tasks? (Farm size further enhanced, weeding and harvesting increased). Who is affected by this change?

What labour is available during the dry season?

### Information flows:

How does information relating to agriculture flow within and between households?

What information is shared between men and women?

Who are the key actors, beyond the level of household, who are responsible for giving out information relating to relations with outside groups etc? Do these people represent all the different groups in the community?

### Institutional issues/socio-political complexity:

What external-based institutions already exist in the community? Who do they work with? How are they organised? (What is their role vis-vis the population?). What is their history in the community?

What internal organisations/groups exist that draw together people from different concessions/compounds/households? How wide is the membership? How are they organised? Who plays what roles?

### Blacksmiths:

Are there blacksmiths in the community? What do they produce and how do they organise their production and sales?

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## Appendix

### PROGRAMME

- 7 March  
Night  
Ouahigouya
- Arrive Ouadagougou. Met by Mr G Son, Head, Programme ESFIMA, INERA
- 8 March  
Night  
Ouagadougou
- Preparation of programme with Mr G Son
- 9 March  
Night  
Ouahigouya
- Depart Ouagadougou for Ouahigouya  
With Mr J Ogier, Head, Farming Systems Team, Ouahigouya, discussion of programme
- Courtesy visit with OXFAM (Agro-forestry project - 'Projet PAF')
- Courtesy visit with Mr Fournage, CRPA and introduction to Justin Tiemtore, technician in charge of field programme.
- Visit Ziga and Bougouré villages: Interview with blacksmiths. Courtesy visit with the President of Farmers Association Sawadogo Sombombo.
- Return to Ouahigouya and programme planning with Mustapha Sawadougou, Extension officer, Ziga
- 10 March  
Night  
Ziga
- Depart for Ziga. Discussions with the 5 1992 participants and the 3 women who participated in the demonstration day, 2 who have expressed interest in making a tine, 1 who has used the tine this year, 4 others who have requested access, 2 blacksmiths and with one or more people in each of the 7 quarters of the village to discuss the disposition of the CH9 plough, other traction equipment and systems of exchange and borrowing. Discussions with extension officer, Mr Mustapha Sawadougou
- 11 March  
Night  
Ouahigouya
- Discussions in Ziga
- Discussions with Mr Matthew Ouedrago, Head, OXFAM programme, Ouahigouya.

12 March  
Night  
Ouahigouya  
Visit Doubaré village with Ms.F.Traoré, sociologist, Farming Systems Team, Ouahigouya. Discussions with Field Assistant, village head, two 1992 demonstration participants, three who have expressed interest in participating in 1993, three women and two blacksmiths. Brief visit to three fields already prepared using the tine and discussions with one group of blacksmiths.

13 March  
Night  
Ouahigouya  
Visit Madougou village with Mr Jean-Pierre Tiendrebeogo, veterinarian, Farming Systems team. Discussions with Farming Systems Team field assistant, 4 farmers who have used, one group of blacksmiths.

14 March  
Preparation of report. Evening Ziga visit with Justin Tiemtore (INERA) and Mustapha Sawadougou (CRPA)

15 March  
Visit OXFAM villages, Breve and Noogo with Justin Tiemtore. Visit demonstration site and general discussion on ownership of draught animals and equipment and participation with OXFAM.

16 March  
Night  
Ouagadougou  
Working session with INERA Farming Systems Team, with CRPA and with OXFAM.  
Return to Ouagadougou

17 March  
Night  
Ouagadougou  
INERA with Mr F Lompo, ESFIMA programme & Mr D Kaboré, Farming Systems Programme. Discussions with Dr Some, Interim Director General, INERA  
Discussions with Mr G Son, programme ESFIMA

18 March  
Night  
Bobo Dialasso  
Depart for CERDRES, Bobo Dioulasso  
Discussions with Dr Gerard Godet, interim Director and Dr A Bassaga, Veterinarian  
Evening discussions with Dr P Klein, RSP  
INERA, Bobo Dioulasso

19 March  
Night  
Ouagadougou  
Discussions with Dr M Mattoni, A Bassaga & G Godet. Depart Bobo Dioulasso  
Discussions with Mr G Son on future programme activities

20 March  
Depart Ouagadougou

8 April  
Arrive Ouagadougou.  
Discussions with Mr Son on other DAP proposals

## Appendix 2

### Report to INERA, CRPA and OXFAM in Ouahigouya, 16 March

1. Objective of the programme and justification of the initial Ziga approach. Comparison with work in the other villages.

2. What has happened to date.

3. A note on the role of women in the use of draught animal power.

4. Issues to be addressed in the immediate future.

5. Possible collaboration with INERA sociologist.

1. Methodological issues in present work in all 5 villages including the method of communication:

Selection of sites: scattered over a wide area which makes monitoring difficult.

Selection of farmers for research tasks: in Ziga selection followed pre-determined pattern of relations with INERA. Long term research partners with set patterns of working etc. In one of INERA's two other villages: worked directly with the family of the field assistant. Selection in OXFAM villages was of someone with draught animal power equipment. Problem of patronage especially difficult with DAP which is a major source of capital.

Selection of tasks to demonstrate: in all new sites, farmers being trained to do specific tasks using the tine rather than researchers learning from farmers. Farmers being asked to choose amongst researcher's propositions for zaë preparation (a second tine, a houe-manga, manual). Yield comparisons.

Ownership of the research: INERA staff borrowing tines left in the villages.

2. Very little farmer use for various reasons: Ziga: said to be traditional rules regarding the start of dry season work. Tine not necessarily well placed for general access. One farmer used - borrowed from extension officer. Three people have requested to borrow the plough from the president's house, three others have stated their intention of making a plough. A second person borrowed and used after our visit and before this meeting. None of the three women involved in the demonstration day have done anything. They

were not even involved in discussions with their spouses who did not participate in the day's activities. Doubaré: tine not readily accessible. Associated with camel of which only 1 in village. Camel owner used. Payment being requested for access to camel by others. Tine attached to INERA plough placed with camel owner. Dynamic picture of draught animal equipment in this village which has close links with Mali. Madougou: most use seen - 4 plots. Farmers detached tine from INERA plough. Work with tine completed without detailed knowledge of INERA farming systems staff. OXFAM villages : work only just started. In Doubaré, Madougou and the two OXFAM villages, the tine demonstrated as a tool for making zaïs.

3. Some women and men in Madougou reported that women actually use equipment and animals. Is this unique to certain villages? Can we actually investigate this during the cropping season?

4. Issues to be addressed in the immediate future: Noted that no detailed monitoring plan prepared for this visit but major issue seen to be to monitor actual use.

Outstanding monitoring of actual use: Okali to prepare a small table to be completed by the extension officer in Ziga. Noted that for the follow up of this information, a more sustained input on the part of the INERA sociologist would be required.

Tines placed in the villages should be left there. There should be no borrowing by INERA staff.

Demonstration of tine attachment to local equipment should be completed in all villages where this not already done.

At Doubaré, tine use with oxen should be demonstrated by a farmer.

Information should be given to farmers about more general use possibilities, outside its use for zaïs.

In Ziga, all **types** of plough (not all ploughs) should be brought together at as large a public meeting as possible (at least one person from each quarter plus the two blacksmiths who have been involved in discussions) and the tine attached to as many as possible.

In each of the villages, a local blacksmiths (not the Ziga blacksmith) should be asked to fabricate a tine and it should be tested by a farmer in the presence of the blacksmith.

Relationship with extension staff who live in the village should be maintained since they are resident all the time.

5. INERA sociologist: more intensive follow-up needed. Is the INERA sociologist likely to be available?

## APPENDIX 4

### LIST OF PEOPLE INTERVIEWED

#### **Ziga:**

Blacksmith: Haruna Belem

Three people who have discussed the ordering of tines with Haruna Belem: Sawadogo Bureima, Ouedrago Mamadou, Ouedrago Rasumanah

Farmers who participated in the February 1992 tests and demonstration: President of the farmers' associations, Sawadogo Issaka, Sawadogo Bureima, Ouedrago Alidou, Ouedrago Moumouni

Farmer who actually did the demonstration in 1992: Sayouba Rasmane

Three people who have approached the President to use the tine this year: Karim Lega, Ouedrago Rasmane, Sawadougou Karim.

One farmer who used the tine in 1993 before my arrival (tine and plough borrowed from the extension representative): Haruna Lega

Two women who participated in the demonstration day in 1992. Two men in Saadogo Quarter.

One man considered to be disadvantaged because he had no animals or traction equipment: Yacouba Sawadougou

#### **Boukere:**

Blacksmith: Belem Mhadi

#### **Madougou:**

Madougou Ousseini (INERA technician), one person who gave land for the 1992 test: Bari Musa. Four people who watched the 1993 tine demonstration: Bari Adama, Belem Ali, Sawadogo Issa, Ouedrago Amadi. Group of blacksmiths. Group of men and women resting in shade.

#### **Doubare:**

The INERA technician. Three individuals who have used the tine this year. Group of blacksmiths.

#### **Oxfam Villages:**

Sawadougou Zimia plus one family group.

**Note:** These individuals were in addition to the INERA staff and extension personnel who participated in the various visits and are listed in the programme in Appendix 1.

Fichier 2: SUIVI DES ACTIVITES DE SOUS SOLAGE, 1993

Village? \_\_\_\_\_

1. Est ce qu'il y a eu quelqu'un qui a voulu utiliser la dent mais qui n'a pas pu? Oui/Non \_\_\_\_\_

Si oui, Qui? \_\_\_\_\_

Par qui a-t'il/elle appris la presence de la dent?  
\_\_\_\_\_  
\_\_\_\_\_

Pourquoi il/elle n'a pas pu l'utiliser?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Est ce qu'il/elle en a parle a d'autres producteurs?  
\_\_\_\_\_

2. Liste des activites des intervenants de l'exterieur qui ont ete concerne par le dent (INERA, CRPA). Noter les activites, les intervenants et qui a participe.

Activites

Les intervenants

Qui a participe

Activites	Les intervenants	Qui a participe
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

3. A quelqu'un fabrique/achete leur propre dent? Oui/Non \_\_\_\_\_

Si oui, qui? Nom \_\_\_\_\_

Quartier \_\_\_\_\_



Fichier 1: SUIVI DES ACTIVITES DE SOUS SOLAGE DURANT LA SAISON SECHE, 1993

Pour chaque personne qui utilise la dent cette année, remplir l'information suivante:

Village? \_\_\_\_\_

<b>INFORMATION PERSONNEL</b>		
Nom	_____	_____
Quartier du village	_____	_____
<b>UTILISATION DE LA DENT</b>		
Sur terre dégradée?	_____	_____
Pour zais?(Oui/Non)	_____	_____
Si non, pour:	_____	_____
Champ de case?	_____	_____
Tous ses champs?	_____	_____
Autres(specifier)	_____	_____
<b>ACCESS A LA DENT</b>		
La dent était avec qui?	_____	_____
Lui-même?(Oui/Non)	_____	_____
Si non, avec qui?	_____	_____
Nom	_____	_____
Son Quartier	_____	_____
Relation entre les deux personnes?	_____	_____
<b>ACCESS A LA CHARRUE</b>		
La charrue est pour qui?	_____	_____
Lui-même?(Oui/Non)	_____	_____
Si non, pour qui?	_____	_____
Nom	_____	_____
Son Quartier	_____	_____
Relation entre les deux personnes?	_____	_____
Paiement ou accès simple?	_____	_____
<b>ACCESS AUX ANIMAUX</b>		
Les animaux sont pour qui?	_____	_____
Lui-même?(Oui/Non)	_____	_____
Si non, pour qui?	_____	_____
Nom	_____	_____
Son Quartier	_____	_____
Relation entre les deux personnes?	_____	_____
Paiement ou accès simple?	_____	_____
<b>PROBLEMES D'UTILISATION</b>		
Technique(explique)	_____	_____
Socio-economic (explique)	_____	_____

MESSAGE DE TELEFAX

EXPEDITEUR: OGIER JOSEPH  
INERA/RSP-YATENGA  
BP. 170  
OUAHIGOUYA

No 05/RSPY/93

BURKINA FASO

DESTINATAIRES: DUGUE PATRICK  
BP. 5035  
34032 MONTPELLIER CEDEX 01

FRANCE

N° FAX DU DESTINATAIRE: 67-41-40-15

Nombre de pages: 3

Date: 25/01/93

Objet: Envoi de renseignements complémentaires  
sur la culture attelée au Yatenga.

Cher Patrick,

J'espère que tu as réussi à mettre la main sur le papier de 3 pages annexé au FAX n° 288/RSPY/92 du 31/12/92 et intitulé "la culture attelée au Nord du Yatenga".

J'espère également que tu as reçu la fiche technique sur le travail du sol à sec à la dent envoyée en courrier ordinaire par BEDU. Il m'a chargé de te dire que ce serait son unique contribution, étant surchargé de travail par ailleurs.

Comme promis, je t'envoie quelques éléments sur l'évolution de la culture attelée à Boukéré et à Ziga. Nous n'avons pas eu le temps de réaliser ce travail dans le village de Sabouna. C'est dommage parce que ce village semble être celui sur lequel tu avais le plus de données statistiques (Recensement des équipements en 82 et 85 figurant dans l'article des cahier de la R/D n° 21 de mars 1989)

**I - BOUKERE**

En 1987 on mentionnait 6 ou 9 exploitations équipées avec 3 charrues et 6 hoes manga et 6 exploitations ayant utilisé ce matériel. En 1992 on a recensé 6 exploitations avec 3 charrues et 3 hoes manga, ce qui indique qu'il n'y a eu aucun achat depuis et que 3 hoes manga ont été vendues.

D'après l'enquête tout le matériel restant est utilisé:

- les houes manga le sont faiblement pour la préparation des sols mais beaucoup pour le sarclage qui est toujours couplé avec un semis au rayonneur et dont les surfaces sont en augmentation.  
les 3 houes sont tirées par des ânes.
- Les charrues (2 bovines et 1 asine) sont utilisées exclusivement pour la préparation du sol. Ces exploitations n'ont pas de rayonneur et ne font pas de sarclage mécanique.
- Il existe 7 rayonneurs dans le village dont 3 avec les possesseurs de houes manga et 4 avec des paysans non équipés. Tous disent continuer à utiliser les rayonneurs, même ceux qui ne sont pas équipés en culture attelée.

Tous ceux qui ont des équipements de culture ont aussi des charrettes asines et il y a 13 charrettes au total dans le village.

En conclusion, en dehors des charrettes on peut dire que la culture attelée est en stagnation ou en régression à Boukéré.

## 2 - A ZIGA

Nous venons de réaliser un recensement exhaustif du matériel et des exploitations équipées:

<u>Types d'équipement</u>	<u>Nombre d'exploitations</u>
Charrue asine + âne	3
Houe manga + âne	7
Charrette + âne	7
Houe manga + charrette + âne	3
Houe manga + cheval	2
Houe manga + boeufs	21
Houe manga + charrette + boeufs + âne	16
Charrue + cheval	7
Charrue + charrette + cheval + âne	6
Charrue + boeufs	4
Charrue + charrette + boeufs + âne	5
charrue + houe manga + boeufs + âne	4
Charrue + houe manga + charrette + boeufs + âne	20
Charrue + houe manga + charrette + boeufs + cheval	2
<b>TOTAL</b>	<b>107</b>

Le total des équipements correspondants est de 76 houes manga, 48 charrues, 62 charrettes, 86 paires de boeufs, 17 chevaux et 65 ânes auxquels il faut rajouter les équipements appartenant au groupement et aux quartiers de culture (ou bassins-versants), sans parler du petit matériel.

- 2 charrues + 3 charrettes pour le groupement villageois
- 4 charrettes pour les bassins-versants (B.V).

Il n'a pas été possible de faire un rapprochement précis avec les données 82 et 87 non suffisamment détaillées dans les documents en ma possession pour cerner l'évolution de 87 à 92. Mais d'après ces chiffres et les interviews il semble que la culture attelée (en nombre d'équipements et en nombre d'exploitations touchées) ait continué à progresser à Ziga de l'ordre de 20% environ.

Des enquêtes plus précises auprès d'un échantillon de 20 exploitants ont montré:

- que la préparation des sols (labour ou scarifiage) est toujours pratiquée, qu'elle est en légère augmentation mais qu'elle ne couvre guère plus de 50% des surfaces semées.
- que le semis au rayonneur est généralisé dans la majorité des exploitations (79 rayonneurs recensés dans le village)
- que le sarclage mécanique à la houe manga, en liaison avec le semis au rayonneur, continue à se développer et qu'il couvre la quasi totalité des surfaces cultivées, dans les exploitations équipées, sauf lorsqu'il y a introduction de niébé en intercalaire ou en association dans la céréale (cas limités semble-t-il).
- que la traction bovine (et équine) continue à prédominer sur la culture asine, malgré les années de sécheresse. Les gens de Ziga, comme cela avait déjà été observé en 84, ont fait le maximum pour conserver leurs paires de boeufs qui ont une force de traction bien supérieure à celle des ânes.

En conclusion on peut dire que la culture attelée continue à se développer à Ziga et que la majorité des matériels vendus ou donnés aux paysans et aux groupements existent encore et sont toujours utilisés. Mais est-ce une situation propre à Ziga, liée à l'encadrement important dont a bénéficié ce village de 1980 à 1990? Cette situation se rencontre-t-elle dans d'autres villages du centre Yatenga ayant bénéficié d'équipements nombreux et de l'encadrement de projets comme le P.A.E. ou le P.A.F.?

En espérant que tous ces renseignements te seront utiles (et te réconforteront), reçois mes amicales salutations.

L. OGIER / -

MESSAGE DE TELEFAX

EXPEDITEUR : OGIER Joseph  
INERA/RSP-YATENGA  
BP. 170

288/RSPY/92

OUAHIGOUYA

DESTINATEUR : DUGUE Patrick  
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FRANCE

N° DE FAX DU DESTINATAIRE

NOMBRE DE PAGES : 1 (celle-ci) + 3 pages jointes

DATE : 31/12/92

Objet: Rédaction article sur la culture  
attelée au Yatenga

Cher Patrick,

Je t'envoie en catastrophe, aux dernières heures de l'année 92, un petit document de 3 pages sans prétention sur la culture attelée au Nord du Yatenga, comme tu me l'avais demandé.

J'espère qu'il n'arrivera pas trop tard et que tu pourras encore l'utiliser. Si tu as besoin de complément d'information, n'hésite pas à me les demander.

On prépare pour début janvier une petite note sur l'évolution de la culture attelée à Ziga et Boukere.  
Amicales salutations.

J. OGIER

P.S.:

- Dans la conclusion de ton article sur la culture attelée dans les cahiers de la R/D n°21 de mars 1989, je ne suis pas d'accord quand tu dis que "la culture attelée n'intervient pas ou très peu" dans l'extensification des systèmes de culture; lorsque la pression foncière est faible. L'exemple de Banh et de Kain prouve le contraire.

- Autre point intéressant à signaler, que j'ai oublié de mentionner dans la petite note :

Pour payer le confiage des animaux au peulh, l'agriculteur est souvent amené à travailler la parcelle du peulh en culture attelée.

# LA CULTURE ATTÉLÉE DANS LE NORD DU YALENGA

## 1 - Généralités:

Les dernières statistiques fournies par l'enquête CRPA de 1991 montrent que la culture attélee est plus faiblement représentée dans les départements du Nord que dans ceux du Sud:

- de 4 à 12% des ménages équipés au Nord de Ouahigouya
- de 19 à 30% des ménages équipés au Sud avec même 56% à Bambo et 61% à Kalsaka (Zogoré fait exception avec 13%).

Elles montrent également que, à la différence du Sud, il y a prédominance des charrues bovines sur les charrues asines avec un très faible nombre de boues manga, surtout dans les départements de Banhi, Kaïn, Koumbri et Thiou. Cela est à mettre en relation avec une plus grande disponibilité en boeufs de trait dans la zone Nord et avec la politique de diffusion pratiquée par l'ORD et le CRPA. L'âne n'est pas ou très peu utilisé pour la préparation des sols et le sarclage; il est presque exclusivement réservé à la traction des charrettes.

## 2 - La culture attélee dans les départements de Banhi et Kaïn

Si les départements de Koumbri et de Thiou peuvent d'une certaine manière se rattacher à la situation du Centre-Yalenga du point de vue conditions de milieu physique et pression foncière, il n'en est pas de même des deux départements de Banhi et Kaïn. Ils sont caractérisés par la plus faible pression foncière de la province et par une large prédominance des sols sableux (sans problèmes graves d'érosion). Cette situation particulière peut induire des modes ou des techniques originales d'utilisation de la culture attélee, révélatrices des véritables stratégies des agriculteurs.

Dans ces deux départements, la culture attélee a démarré plus tardivement (fin des années 70-début des années 80) à cause de l'éloignement de Ouahigouya et du faible encadrement. De ce fait elle n'a pas connu de forte régression en 83 - 84 et a même continué à progresser régulièrement depuis grâce au crédit d'abord (1984) et ensuite à des achats au comptant auprès de fournisseurs (du Mal ou d'autres paysans du Yalenga obligés de se séparer de leur matériel.

Des enquêtes plus précises réalisées dans un village de Banh (Nogodoum) et un village de Kaïn (Kaïn-Ouro) ont même révélé des niveaux d'équipement supérieurs à ceux figurant dans l'enquête CRPA de 91.

#### A Nogodoum:

Le taux d'équipement est de 18% et même de 22% si on ne prend en compte que les agriculteurs. Ce matériel appartient principalement aux migrants mossi (50% la population) et il est concentré en partie dans les mains de quelques riches commerçants qui l'utilisent dans des campements de culture implantés sur les sols sableux de la bande dunaire (Tiabwal, Yogono, Senodiao) à plusieurs kilomètres de Nogodoum. Les peulhs sont totalement dépourvus de matériels et les agriculteurs rimaïbé qui en ont reçu à crédit ne l'utilisent presque pas ou l'ont vendu.

#### A Kaïn-Ouro:

Le taux d'équipement est de 32% et même de 45% si on ne considère que les agriculteurs. Le matériel est assez bien réparti entre dogon (45%) mossi et fulsé (29%). La possession de ce matériel ne semble pas liée à des activités commerciales mais à des revenus tirés de l'élevage ou de la vente d'excédents céréaliers.

Les peulhs et les bella (26%) n'ont aucun équipement sauf un peulh qui dispose d'une charrue tirée par un chameau.

### 3 - Les techniques d'utilisation du matériel à Kaïn et à Banh

Il n'existe qu'un seul outil, la charrue, et celle-ci, ce qui est assez paradoxal, est utilisée presqu'exclusivement sur les sols sableux dunaires.

Les principales raisons sont:

- qu'ils sont bien représentés dans ces deux départements
- que des surfaces sont encore disponibles pour la culture
- qu'ils sont faciles à travailler
- qu'ils peuvent produire même en période de faible pluviométrie, du fait d'un bon comportement hydrique (RFU élevée).

Ils répondent donc bien à la stratégie des agriculteurs d'extension (ou d'extensification) des surfaces cultivées, consécutive à la baisse de la pluviométrie et des rendements. Les agriculteurs de Kain disent que c'est grâce à la culture attelée qu'ils sont encore autosuffisants et qu'ils arrivent à dégager des excédents en bonne année.

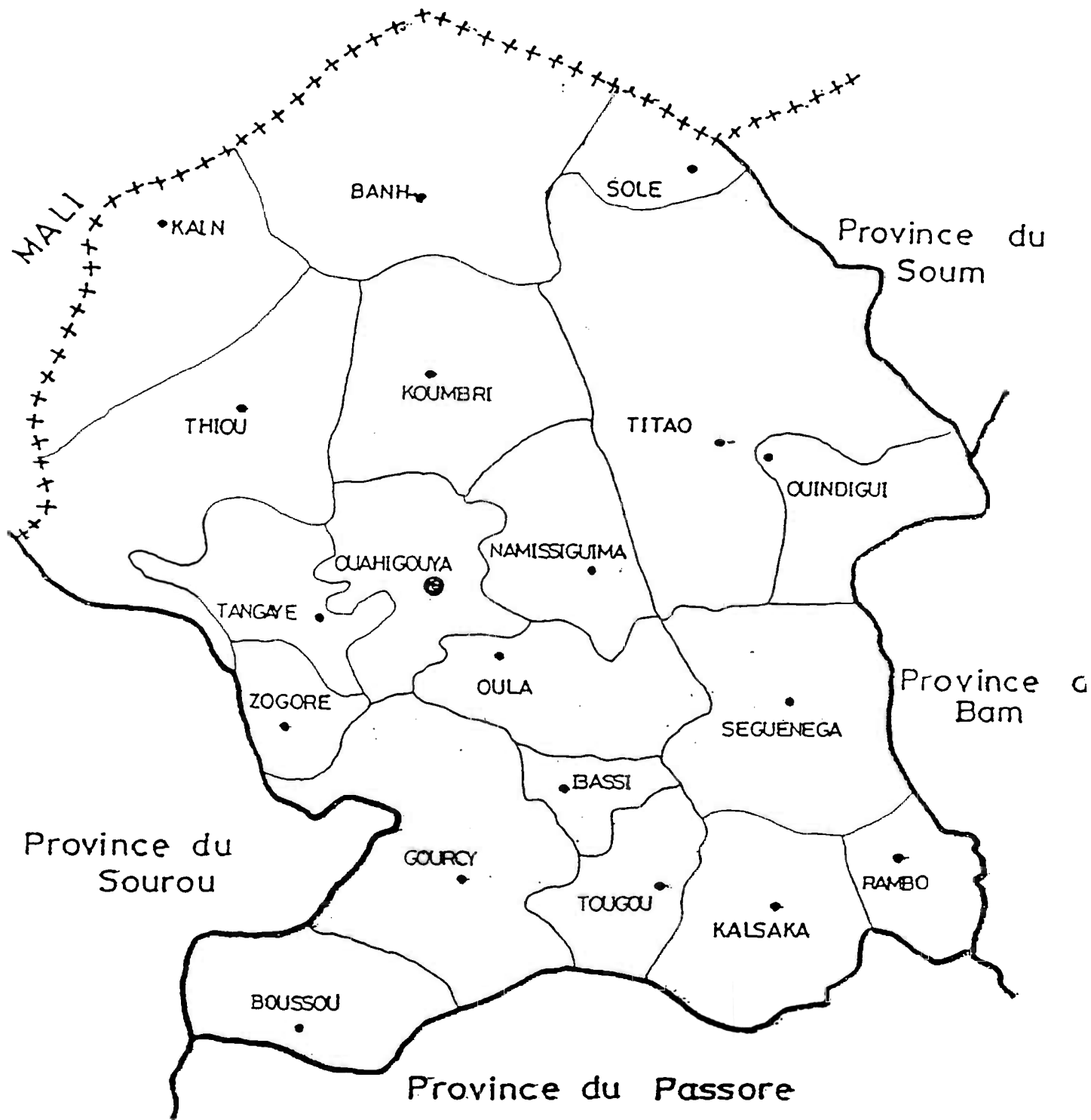
Pour la préparation du sol la seule technique utilisée est la culture en billons parallèles, avec semis sur billon (ce qui dispense de l'utilisation du rayonneur). Le premier sarclage peut être réalisé à la charrue selon la technique du débattage, mais il n'est pas généralisé partout parce qu'il demande une certaine expérience et des animaux dociles. Il est mieux maîtrisé par les dogons que par les mossi. On pense que ces techniques sont directement inspirées de la culture traditionnelle manuelle en buttes et qu'elles ont probablement été introduites depuis le Mali. La culture attelée n'est pas ou rarement utilisée pour le deuxième sarclage.

Les boeufs de trait sont de plus en plus remplacés par les chameaux qui ont été introduits par les bellas à partir de 84 - 85: ils présentent plusieurs avantages:

- ils travaillent plus vite que les boeufs
- ils sont plus faciles à conduire, surtout pour le sarclage
- ils sont plus rustiques et plus faciles à nourrir (utilisation des fourrages ligneux).

J. OGIER /





**LEGENDE**

- +++ Limite d'Etat
- Limite de Province
- Limite de Département
- Chef lieu de Province
- Chef lieu de Département

Echelle: 1/300 000

RAPPORT DE SUIVI DES PARCELLES

TRAVAILLEES EN SEC A ZIGA PAR

L'INSTITUT SILSOE ET L'INERA

## I. OBJECTIF DU SUIVI

Ce suivi a pour objectif de connaître la réponse des paysans bénéficiaires après les journées de démonstration effectuées dans leurs parcelles.

Ce suivi consistait en quatre périodes de visites dont les périodes de semis et de tallage ont été effectuées ainsi que l'analyse granulométrie a été effectuée.

Il a été effectué trois missions sur le terrain : prélèvement du sol, visite périodique de semis, profil racinaire. Le suivi quotidien a été réalisé par l'agent CRPA sur place.

## II. ANALYSE GRANULOMETRIQUE DU SOL

Les résultats obtenus ont été consignés dans les tableaux 1 et 2.

La pénétrométrie n'a pu être réalisé par manque d'appareil et l'humidité du sol et la densité apparente n'ont pu être réalisées en raison de quelques pluies précoces tombées à Ziga avant les prélèvements.

TABLEAU 1. DONNEES DE L'ANALYSE

		A %	LF %	G %	SF %	SG %	E.G%> 2 mm	Type sol	
Boureima	P <sub>3</sub>	17	6,40	16,20	39,68	20,80	4,89	Sable-limoneux	
	P <sub>1</sub>	11,20	6,60	21,04	40,96	20,20	54,25	Gravillonnaire	
	P <sub>2</sub>	13,60	1,80	16,72	50,56	17,32	3,58	Sableux	
	P <sub>1</sub>	20,80	5,20	18,88	36,20	18,92	13,07	Sable-limoneux	
	P <sub>2</sub>	9,40	2,40	10,76	42,96	34,48	4,76	Sableux	
	P <sub>3</sub>	20,40	3,80	16,40	48,60	10,80	0,59	Sable-argilo- limoneux.	
	P <sub>1</sub>	20,60	6,80	20,96	29,28	22,36	58,22	Gravillonnaire	
	P <sub>2</sub>	13,40	4,00	9,76	45,76	27,08	5,61	Sableux(den	
	Tumouni	P <sub>1</sub>	18,20	1,80	14,00	48,16	17,84	6,00	
		P <sub>2</sub>	17,80	1,20	16,84	46,16	18,00	3,93	

N.B.

Argile  
: Limon Fin  
: Limon Grossier

SF = Sable  
SG = Sable Grossier  
EG = Eléments  
(gravi

supérieurs à 2 mm

COMMENTAIRE SUR L'ANALYSE GRANULOMETRIQUE DES PARCELLES

L'analyse granulométrique a permis de corriger les types de sol considérés lors de la visite de février 1992 à Ziga.

L'analyse des résultats obtenus en largeur de travail, profondeur de travail, et efforts de traction en fonction du type de sol seront révisés eu égard aux résultats obtenus dans la caractérisation des sols. Les modifications intervenues sont les suivantes :

**TABLEAU 2 CORRECTION DES CARACTERISTIQUES DES SOLS**

NOM ET PRENOMS	NUMERO PARCELLE	ANCIENNE CARACTERISATION	NOUVELLE CARACTERISATION
SAWADOGO Boureima	P <sub>1</sub>	Sol gravillonnaire	Sol gravillonnaire
	P <sub>2</sub>	Sol sableux	Sol sableux
	P <sub>3</sub>	Sol argileux	Sablo-limoneux
SAWADOGO Issaka	P <sub>1</sub>	Sol gravillon.	Sablo-limoneux
	P <sub>2</sub>	Sol sableux	Sol sableux
	P <sub>3</sub>	Sol argileux	Sablo-argile-limoneux.
OUEDRAOGO Alidou	P <sub>1</sub>	Sol gravillon.	Sol gravillon.
	P <sub>2</sub>	Sol sableux	Sol sableux(dent CRPA)
OUEDRAOGO Moumouni	P <sub>1</sub>	Sol argileux	Sol sableux
	P <sub>2</sub>	Sol-sablo-argileux	Sol sableux

Dans toute la suite du texte, les mêmes numéros de parcelle seront considérés pour une meilleure compréhension.

**III. SUIVI DE LA PERIODE DE SEMIS**

La période de semis a été très étalée (deux mois environ) en raison d'une part de l'installation tardive des pluies et d'autre part par leurs irrégularités. Aussi les paysans possèdent environ 5 à 6 parcelles et ils établissent leur calendrier de travail des parcelles en fonction de la culture à mettre en place, de la nature du sol et de la régularité des pluies.

Pour les raisons sus-citées, il a été demandé à l'agent CRPA sur place de suivre les travaux de préparation du sol.

Les résultats obtenus sont consignés dans le tableau 3.

Les données reçues sur le tallage, n'ont pas été significatifs au regard des dates de semis très disparates

TABLEAU : 3. SUIVI DE LA PERIODE DE SEMIS

Noms et Prénoms	Dénomination Parcelles	Préparation du sol	Date de semis	Type de culture	Pluviométrie cumulée	OBSERVATIONS
SAWADOGO Boureima	P <sub>1</sub> P <sub>2</sub> P <sub>3</sub>	Zaï Labour à la chaîne Zaï	25/06/92 22/07/92 17/07/92	Sorgho Arachide Sorgho		-Sous solage facilite le Zaï -Meilleure infiltration -Levée satisfaisante en parcelles sous-solées -Souhaités : écartement sous-solage à 40 cm d'espacement. -Difficultés : manque de matière première chez le forgeron et difficulté d'adaption aux équipements existants.
SAWADOGO Issaka	P <sub>1</sub> P <sub>2</sub> P <sub>3</sub>	Zaï Labour à plat Labour à la charrue	05/06/92 15/07/92 09/06/92	Sorgho Petit mil Sorgho		}-Satisfaisant du point de vue infiltration ; mais }souhaite sens de sous-solage }parallèles aux courbes de }niveaux. - manque d'outils pour poursuivre.
OUEDRAOGO Alidou	P <sub>1</sub> P <sub>2</sub>	Zaï Labour	01/06/92 30/07/92	Sorgho Mil-Niébé-Sorgho		- Sous-solage facilite le zaï, car permet l'utilisation des enfants pour la réalisation des trous du Zaï.
OUEDRAOGO Mounouri	P <sub>1</sub> P <sub>2</sub>	Labour "	20/07/92 "	Mil "		En réalité P <sub>1</sub> et P <sub>2</sub> sont sur le même site à des points différents.

Commentaire : Les paysans ont été laissés à eux-mêmes ; orienter les travaux à leur gré. C'est pour cette raison que les cultures ne sont pas les mêmes sur les parcelles.

Les principales observations faites sont

Le sous-solage n'a pas modifié ni l'itinéraire culturel du paysan, ni son calendrier de travail du sol. Cela peut-être dû aux très faibles superficies sous-solées.

Il a été reconnu par les paysans que le sous-solage facilite la mise en place du Zai. A cet effet, ils auraient préférés un sous-solage croisés à 40 cm d'intervalles.

Les parcelles sous-solées perpendiculairement ou obliquement aux courbes de niveau entraînaient une érosion du sol.

Le forgeron a été sollicité par deux paysans pour fabriquer la dent mais il ne disposait pas de matière d'oeuvre en ce moment si bien que la commande a été différée à l'année prochaine.

Après la visite, l'INERA a prêté une dent adaptée à la charrue type CNEA, mais il y a eu des difficultés d'adapter cette dent aux houes MANGA pour ceux qui avaient la possibilité de faire encore le sous-solage.

#### IV. ETUDES DU PROFIL RACINAIRE

Le profil racinaire a été réalisé seulement dans les parcelles ayant le sorgho local en culture pure pour permettre une meilleure interprétation. Le profil a été réalisé sur les parcelles suivantes :

SAWADOGO Ecoureima :  $P_1$  = Sol gravillonnaire  
 $P_2$  = Sol argileux.

SAWADOGO Issaka :  $P_1$  = Sol gravillonnaire  
 $P_2$  = Sol sablo-argilo-limoneux.

Le profil a été réalisé sur un terrain (non sous-solé) sur la partie sous-solée.

Les résultats sont portés dans le tableau 4 ci-dessous.

TABLEAU 4. : PROFILS RACINAIRES EFFECTUES SUR CERTAINES PARCELLES A ZIGA

NOM ET PRENOMS	Type de sol	Travail à la dent	DESCRIPTION DU PROFIL	NOMBRE RACINES PAR TRANCHE DE PROFONDEUR			
				0 à 20 cm	20 à 40 cm	40 à 60 cm	+ de 60 cm
SAWADOGO Issaka	P <sub>1</sub>	Oui	Profondeur du trou = 60 cm Horizon A = 0 à 15 cm sableux-limoneux sombre Horizon B = 15 à 50 cm argilo-sableux couleur rose Horizon C = 50 à 60 cm cuirasse gravillonnaire Hauteur du plant = 220 cm Hauteur Moy. plant = 174 cm	76	13	00	00
	P <sub>2</sub>	Témoin	Profondeur du trou = 55 cm Horizon A = 0 à 15 cm sableux limoneux Horizon B = 15 à 40 cm argileux-sableux Horizon C = 40 cm et plus : cuirasse gravillonnaire Hauteur du plant = 165 cm Hauteur moyenne des plants = 135 cm	142	26	00	00
	P <sub>3</sub>	Oui	Profondeur du trou = 76 cm Horizon A = 0 à 25 cm = sablo-arigleux- limoneux Horizon B = 25 à 76 cm = argilo-sableux Hauteur du plant = 135 cm Hauteur moyenne des plants = 172 cm	125	24	03	00



SAWADOGO Issaka	P <sub>1</sub>	Témoin	Profondeur du trou = 75 cm Horizon A = 0 à 25 cm sablo-limoneux-gravillonnaire Horizon B = 25 à 75 cm argilo-sableux Hauteur = 125 cm Hauteur moyenne des plants = 180 cm	100	14	00	00
SAWADOGO Boureima	P <sub>1</sub>	Oui	Profondeur du trou = 60 cm Horizon A = 0 à 25 cm sablo-limoneux-gravillonnaire Horizon B = 25 à 60 cm argilo-sableux avec cuirasse gravillonnaire Hauteur plant = 220 cm (stade gonflement) Hauteur moyenne des plants = 230 cm	153	00	00	00
	P <sub>1</sub>	Témoin	Profondeur du trou = 60 cm Horizon A = 0 à 30 cm = sablo-limoneux-gravillonnaire Horizon B = 30 à 60 cm Hauteur du plant = 210 cm (stade gonflement) Hauteur moyenne des plants = 194 cm.	213	48	00	00
SAWADOGO Boureima	P	Oui	Profondeur du trou = 60 cm Horizon A = 0 à 20 cm sablo-argileux Horizon B = 20 à 60 cm argilo-sableux Hauteur du plant 360 cm (stade floraison) Hauteur moyenne des plants = 302 cm	193	22	01	00
	P <sub>1</sub>	Témoin	Profondeur du trou = 84 cm Horizon A = 0 à 20 cm sablo-argileux Horizon B = 20 à 85 cm argilo-sableux Hauteur du plant = 300 cm (stade floraison) Hauteur moyenne des plants = 303 cm	168	25	00	00

N.B. = Témoin = partie de la parcelle nous sous-solée.