# MAIZE PRODUCTION EFFICIENCY IN THE ARSI NEGELE FARMING ZONE OF ETHIOPIA: A GENDER PRESPECTIVE

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***ABSTRACT***

*The purpose of the study was to identify the major factors influencing the maize production of male-headed and female-headed households. The behavioural analysis and intervention model developed by Düvel, (1975, 1991) was used as the conceptual basis to guide the investigation, which involved a random sample of 120 male and 33 female heads of households.*

*The differences in adoption behaviour can be attributed primarily to differences in the knowledge level and perceived production efficiency, which are closely associated with gender. The effect of gender becomes manifested in significant differences in education, draught power (number of oxen), and access to extension and to credit.*

## 1. INTRODUCTION: THE PROBLEM

About 85% of the Ethiopian population is rural and highly dependent on agriculture. The sector is dominated by rain-fed, subsistence and traditional agriculture and its food production is much lower than the population growth (FAO, 2001).

In the past three decades, different extension strategies have been implemented in Ethiopia to assist small-scale farmers to operate and produce effectively. Whenever extension services targeted women farmers – usually provided by the Home Economics section - this was done in the context of their traditionally accepted domestic roles with the primary focus on nutrition, sanitation, family planning, fuel efficiency, etc.

Over time gender roles and responsibilities have changed. It is for this reason that an investigation into the circumstances of women farmers has become

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essential. Only with a better understanding of their situations and the dynamics influencing them, can extension approaches and strategies be appropriately adapted and implemented.

## 2. THEORETICAL BASE AND HYPOTHESES

Differences in production efficiency between male and female farmers can probably be attributed to differences in adoption behaviour, which, according to Lewin's field theory (1951), can be attributed to variations in their life space. In a further development or adaptation of the field theory, Düvel (1975, 1991), associated the field forces or immediate precursors to behaviour with the needs, perceptions and knowledge through which all other independent variables become manifested in adoption behaviour. Based on Düvel's (1991) model, an inter-relationship of causal factors was hypothesised as indicated in Figure 1.

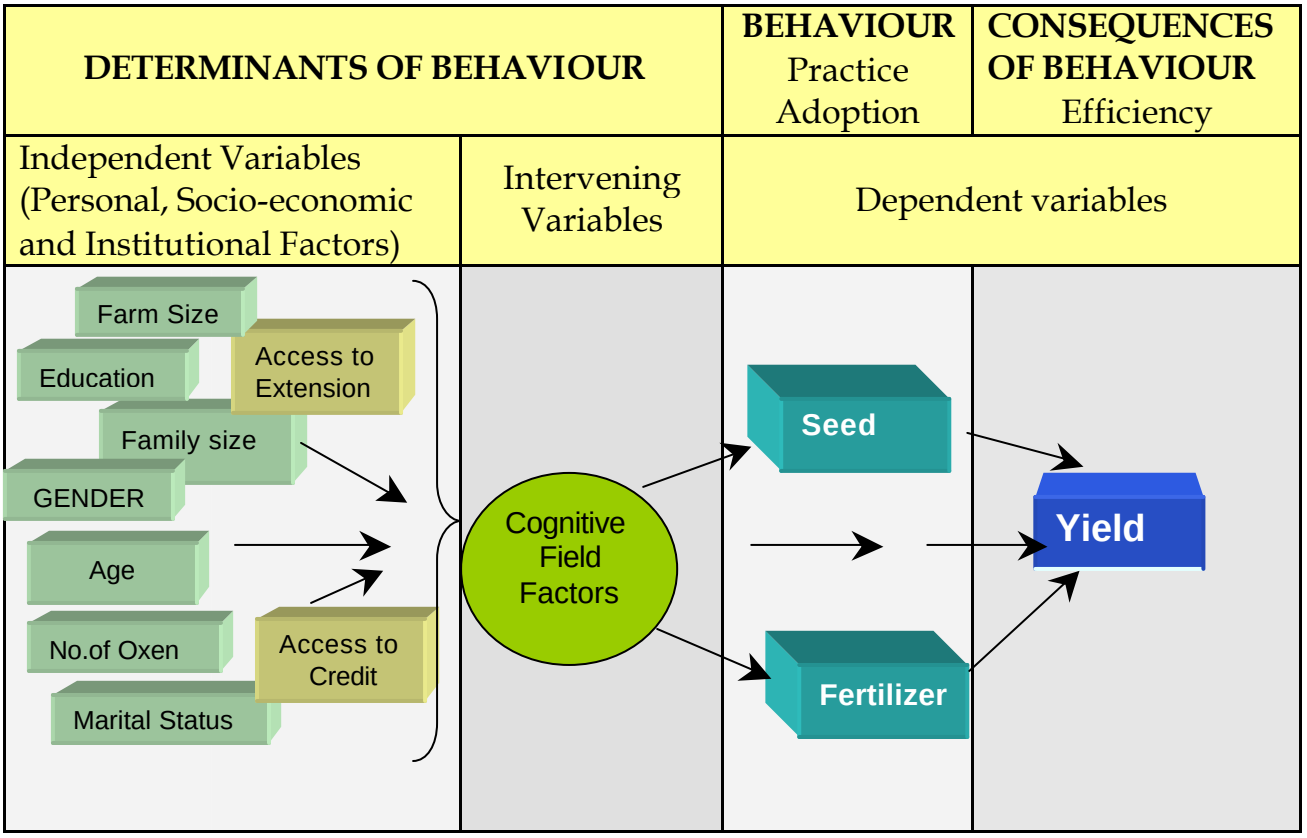


**Figure 1: The hypothesised determinants of production efficiency of rural households in the Arsi Negele farming zone**

With the focus of the article being on identifying the major factors influencing farm level productivity for male-headed and female-headed households the following research hypotheses were formulated:

***Hypothesis 1:*** Production efficiency (mainifested in terms of yield) is a function of the adoption of improved practices and in particular the recommended use of fertilizer and the use of improved seed.

***Hypothesis 2:*** The influence of gender on improved practice adoption and efficiency is in an interdependency relationship with other personal and socio-economic factors and manifests itself through these variables and ultimately through the intervening variables (knowledge, perception and needs) to become functional in adoption behaviour (adoption of recommended seed and fertilizer) and the consequent increased yield.

## 3. RESEARCH METHODOLOGY

The research instrument, a semi-structured interview schedule, was developed by means the conceptualisation of the problem based on the behaviour analysis and intervention model (Düvel, 1991), as adapted in the hypothetical model in Fig. 1. The survey area, consisting of five randomly selected peasant associations being homogeneous in terms of physical characteristics (such as size of land, living standards and marketing facilities. The sample size was based on the norm established by the Ethiopian Central Statistics Authority and proportionally based on the number of male and female headed-households. The total sample size (153) ultimately consisted of 120 male-headed and 33 female-headed households and interviews were conducted by means of structured and semi-structured interview schedules.

The reliability of responses was enhanced by purposeful attempts to involve the communities and their leaders in the early planning of the survey. Use was made of enumerators who were well acquainted with the local cultures and customs and also well trained regarding the content and purpose of the questionnaire. The survey was conducted under the close supervision of the second author who regularly attended interviews and supervised the data analysis of the questionnaires after completion of the interviews.

## 4. RESULTS AND DISCUSSION

### 4.1 Production efficiency

Comparisons between the male and female respondents revealed significant maize yield differences. These findings, also used as criteria of production

efficiency, are shown in Table 1. The average yield for the male respondents was 2559 kg/ha and 1629 kg/ha for the female respondents, which amounts to a very significant statistical difference (t = 4.129, d.f. = 134, P = 0.000) and confirms the assumed problem that led to this investigation. Expectations are that the differences in yield between male- and female-headed households will also be manifested in differences in the adoption of recommended practices (Hypothesis 1).

**Table 1: The maize yields of male and female farmers in kg per hectare in Arsi Negele, 2001**

| Maize yield | Male | Female |
|---|---|---|
| | **n = 110** | **n = 26** |
| Maximum | 5000 | 3600 |
| Minimum | 600 | 500 |
| Mean | 2558.5 | 1628.92 |
| Std. Deviation | 1063.6074 | 883.8007 |

*(t = 4.129, d.f. = 134, P = 0.000)*

## 4.2 Adoption of recommended practices

### *4.2.1 Use of improved seed*

The use of recommended seed varieties is expected to contribute to improved production in the form of higher yields. Support for this assumption (Hypothesis 1) was found in the case of both male (r = 0.796, p = 0.000) and female households (r = 0.572, p = 0.001). However, when comparing these, it is very clear that female farmers are less inclined to use the recommended seed varieties see Table 2.

61% of the male respondents and only 25% of the female respondents use improved maize seed, which largely explains the difference in production efficiency between the male- and female-headed households. 22 percent of the female respondents still use local varieties as opposed to only 6 percent in the case of males. Some cause of concern and probably a reason for yield discrepancies is that a significant (number 33 percent males and 38 percent females) use their own hybrid rather than the clean certified hybrid seed obtainable through the Ministry of Agriculture's extension package programme.

**Table 2: The seed used by male and female respondents in Arsi Negele, 2001**

| Seed Variety | Seed from Ministry of Agriculture | | Own seed or seed from other source | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| A-511 | 25 | 12.5 | 29 | 38 |
| BH-160 | 2 | | | |
| BH-140 | 7 | 3 | | 3 |
| PBH 325 | 27 | 9 | 4 | 0 |
| Local | | | 6 | 22 |
| **TOTAL** | **61** | **24.5** | **39** | **63** |

### *4.2.2 Use of fertilizer*

According to the findings and in concurrence with Hypothesis 1, the use of fertilizer resulted in significant yield differences for both male and female respondents. The correlation between fertilizer application and yield is 0.68 ($p = 0.000$) in the case of males and 0.57 ($p = 0.0001$) in the case of female-headed households. The differences between male and female farmers in regard to the application of fertilizer are shown in Table 3.

**Table 3: A comparison between male and female respondents regarding the adoption of recommended fertilization, 2001**

| Adoption status | Male | Female |
|---|---|---|
| Adoption of fertilizer | 79 | 46 |
| Non-adoption of fertilizer | 21 | 54 |
| Mean Urea application | 89kg/ha | 75 kg/ha |
| Mean DAP application | 83 kg/ha | 78 kg/ha |

UREA (46% Nitrogen) and DAP (Di-Ammonium Phosphate) are the two major fertilizer types used in the country and are distributed to the farmers through the Ministry of Agriculture in a form of credit. More than half of the female respondents, as opposed to only 21 percent of the male respondents, did not use any fertilizer and the mean amount of fertilizer used for maize was also lower in the case of female respondents. It is noteworthy that only those female farmers that received fertilizer from the ministry used the recommended fertilizer rate.

## 4.3 Personal characteristics

### *4.3.1 Farmers' age*

Female farmers are in general somewhat younger than male farmers. The calculated mean age of male and female respondents was 43 years and 39 years respectively. These ages are an approximation because more than half of the female respondents and 10 percent of the male respondents were unsure of their age. As far as the influence of age on production efficiency or the adoption of improved practices is concerned, no significant relationship could be found.

### *4.3.2 Education*

The very significant difference between the formal education of male and female farmers is apparent from Figure 2.

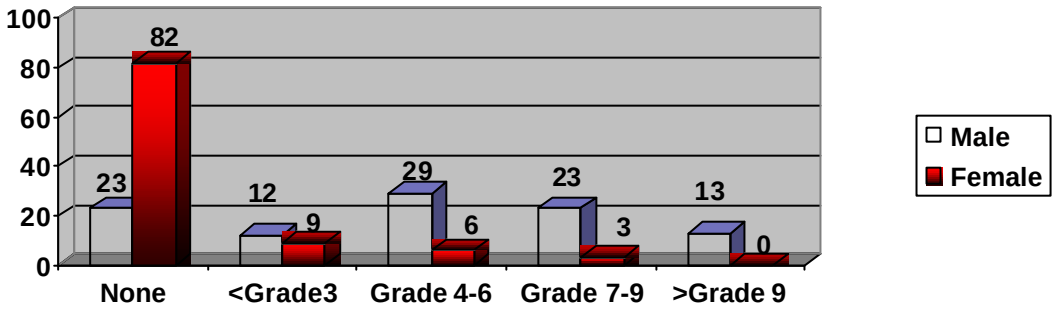


**Figure 2: The formal qualification of male and female farmers in Arsi Negele, 2001**

The noticeable finding is the low formal qualification of female respondents. As many as 82 percent have no formal qualifications, as opposed to 23 percent of the male respondents. The importance of this formal education is manifested in the relationship of education with production efficiency (yield) and practice adoption (Table 4).

As far as male respondents are concerned, there is a highly significant correlation in all cases. The fact that Hypothesis 1 is not supported in the case of female respondents must be attributed to the lack of variation regarding formal education rather than its limited influence.

**Table 4**: **The relationship between the formal education of male and female farmers and their production efficiency (yield) and practice adoption (seed and fertilizer), 2001**

| Production aspect | Male | | Female | |
|---|---|---|---|---|
| | r | p | r | p |
| Yield | 0.246 | 0.010 | 0.120 | 0.55 |
| Adoption of seed | 0.209 | 0.023 | 0.04 | 0.816 |
| Adoption of fertilizer | 0.241 | 0.011 | 0.021 | 0.94 |

### *4.3.3 Marital status*

The majority of female respondents are widowed. Almaz (2000) reported the number of female-headed households in Ethiopia to be 21%, but this figure is, according to Addis et al (2001) steadily increasing. As far as the survey sample is concerned, the majority of female (respondents 94%) are widowed, while the remaining 6 percent had absentee husbands. None of the male respondents were widowed and this overall lack of variation prevented a meaningful analysis of the influence of this relationship on farming efficiency and practice adoption.

With male respondents the dominant type of marital status was monogamy (58%), and yet polygamy was also quite common (38%). Most of the female respondents considered their quality of life to be much more inferior to that of women whose husbands were around, because of the absence of a partner to support and to share the burdens and tasks of the different roles and responsibilities. They are engaged in domestic responsibilities as a mother and housekeeper, and productive responsibilities as a farm manager. Findings also indicated that female respondents were often engaged in sharecropping to overcome their labour, oxen and cash constraints.

## 4.4 Socio-economic characteristics

### *4.4.1 Household size*

The average household size of male-headed and female-headed households is 10.44 persons and 7.09 persons respectively, which is an indication that female-headed households tend to be smaller. This is similar to the findings of Truneh *et al* (2000) in the central parts of Ethiopia. There is no significant relationship between family size and production efficiency or the use of improved maize seed and recommended fertilizer application.

### *4.4.2 Farm size*

Land holdings among the respondents ranged from .25 ha to 5.25 ha. The mean land holding for female respondents was 1.1 hectares, and that of male respondents 1.67 hectares. Some of the male respondents hired additional land to grow improved maize cultivars. The findings of Yohannes *et al* (1990) showed that farm size was significantly related to the use of improved practices in some parts of Ethiopia. However, in this study no significant influential relationship could be found. This is in agreement with Legesse's (1992) findings that farm size was not an important factor affecting the probability of the adoption of improved maize seed or fertilizer.

### *4.4.3 Draft power*

Female respondents tended to have fewer oxen as compared to the male respondents. In fact 58 percent have no oxen as compared 21 percent of the male respondents. Mwangi *et al* (2000), found that the number of livestock had a positive and significant impact on the adoption of maize seed in male-headed households only. As shown in Table 5 the findings of this study are very similar.

**Table 5**: **The relationship between the number of oxen owned by male and female farmers and their production efficiency (yield) and practice adoption (seed and fertilizer), 2001**

| Production aspect | Male | | Female | |
|---|---|---|---|---|
| | R | p | r | p |
| Yield | 0.429 | 0.000 | 0.144 | 0.262 |
| Adoption of seed | 0.475 | 0.000 | 0.419 | 0.114 |
| Adoption of fertilizer | 0.236 | 0.004 | O.144 | 0.262 |

In the case of male respondents the correlations between the number of oxen and all production aspects are highly significant, implying that the more oxen the farmers own, the more likely they are to adopt the recommended seed and fertilizer application, and consequently the higher the resulting yields are likely to be. The likely reasons for correlations not to be significant in the case of female respondents is the limited variation regarding cattle ownership.

## 4.5 Support services

### *4.5.1 Extension support*

According to the information obtained from respondents (Table 6), the two major sources of agricultural information are extension agents and neighbouring farmers.

**Table 6: Distribution of farmers according to their most important source of agricultural information, Arsi Negele, 2001**

| Sources | Male respondents | | Female respondents | |
|---|---|---|---|---|
| | N | % | n | % |
| Fellow farmers | 20 | 17 | 26 | 79 |
| Extension agents | 81 | 67 | 5 | 21 |
| Demonstration | 17 | 14 | - | - |
| Field day | 2 | 2 | - | - |
| **TOTAL** | **120** | **100** | **31** | **100** |

67 percent of male farmers relied on extension agents as their main source of information as opposed to only 21 percent of the female farmers. The latter depend significantly more on fellow farmers. The more limited support that female farmers receive from development agents is also evident from the fact that 82 percent of female respondents and 35 percent of the male respondents had no contact with them. In fact, more than half (57%) of the female respondents were not aware of the presence of development agents in the area, which seems to correspond with figures released by the C.I.S.P (1997), namely that female farmers' involvement in extension activities is less than 5 percent.

**Table 7: The relationship between the frequency of extension contact of male and female farmers and their production efficiency (yield) and practice adoption (seed and fertilizer), 2001**

| Production aspect | Male | | Female | |
|---|---|---|---|---|
| | r | p | r | P |
| Yield | 0.423 | 0.000 | 0.464 | 0.008 |
| Adoption of seed | 0.379 | 0.000 | 0.303 | 0.046 |
| Adoption of fertilizer | 0.327 | 0.000 | O.656 | 0.000 |

The highly significant correlations between frequency of extension contact and all the production aspects (higher yield and adoption of seed and fertilizer) found in the case of both male and female farmers (Table 7) does indicate that the poorer performance of female farmers can largely be attributed to the poorer contact with extension.

### 4.5.2 Access to credit

Although the availability and access to credit facilities play a vital role in terms of increasing farm productivity, there are no formal credit facilities for cash in this particular study area. The major type of credit is provided in the form of inputs, which include improved seed, fertilizer and pesticide. The major source of these inputs is the Ministry of Agriculture (the government) under the extension package programme as mentioned earlier.

The tremendous difference between the access to, or the use of credit between male and female respondents is very evident from Figure 3, which reflects the degree to which respondents made use of credit under the package program. 63.6 percent of the females never used credit, whilst this percentage among male respondents is 18.5. On the other extreme the percentage of males and females making maximum use of credit facilities is 67.2 and 24.2 respectively. These highly significant differences between male and female farmers probably go a long way in explaining the differences in production and production efficiency.

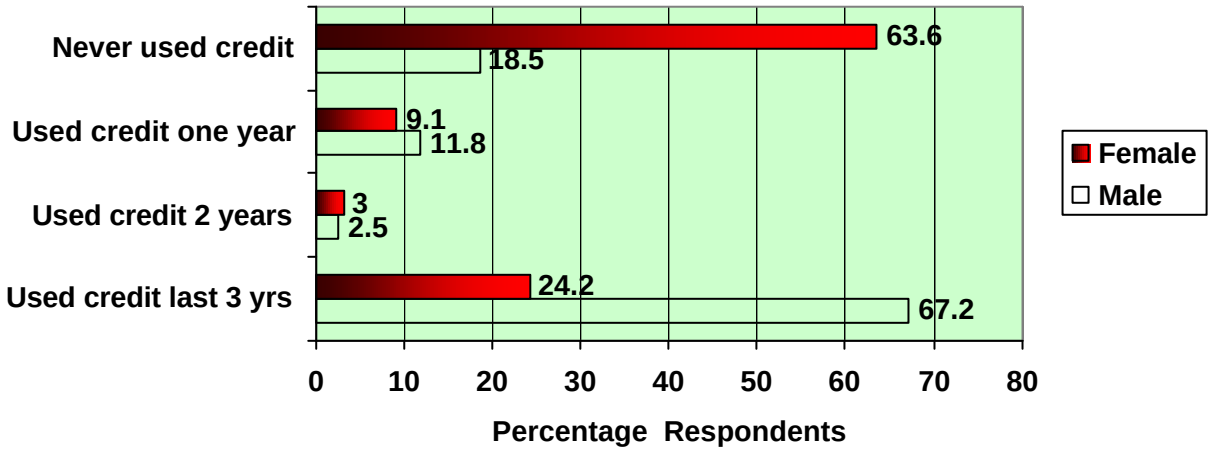


**Figure 3: The use of agricultural credit facilities by male and female respondents in Arsi Negele, 2001**

### 4.6 Intervening variables

Male and female farmers' perceptions of their knowledge of maize production and of their production efficiency are summarised in Table 8 and in both cases the assessment by males is significantly higher.

**Table 8: The percentage distribution of male and female farmers according to their assessment of their knowledge of maize production and their production efficiency, 2001**

| Scale point | Knowledge of production | | Perception of production efficiency | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| Very poor | - | 3 | - | 6 |
| Poor | 2 | 46 | 4 | 43 |
| Reasonable | 48 | 18 | 57 | 24 |
| Good | 39 | 30 | 34 | 18 |
| Very good | 11 | 3 | 5 | 9 |

While only two percent of the male respondents regard their maize production knowledge to be poor, 51 percent of the female farmers perceive themselves in that category. It can be argued that the perceived knowledge need not reflect the real knowledge, but there is reason to accept that these findings do reflect the comparative knowledge levels.

A similar tendency exists in terms of the perceived production efficiency, which, according to Düvel's behaviour and intervention model (1991), is directly related to the certain need facets. The fact that 49 percent of female respondents assessed their current efficiency to be poor or very poor compared to the 4 percent of male respondents, possibly implies that addressing female farmers' needs is conducive to an improvement of production efficiency, which in the case of male farmers has probably already led to a change in adoption behaviour and increased yield.

## 5. CONCLUSIONS

The widely observed lower effectiveness and efficiency of female farmers, which is evident in the significantly lower maize yields than those of male farmers ($t = 4.129$, d.f. = 134, $P = 0.000$) can, according to the research hypothesis (Hypothesis 1) be attributed to a poorer adoption of recommended seed and fertilizer applications. Highly significant correlations provided

supportive evidence of this hypothesis in the cases of both male and female respondents.

The differences in gender can, in concurrence with Hypothesis 2, be attributed to other more dependent variables, namely education, draught power (number of oxen), access to extension and credit and knowledge, perception and needs regarding maize production. From the magnitude of the correlation coefficients, it appears that the more dependent the variables the bigger their influence on adoption behaviour and the resulting production efficiency. Particularly significant are access to extension and credit, and knowledge, perception and needs regarding maize production. Access to extension and credit are, according to Düvel's model of behaviour analysis and intervention (1991), equivalent to aspects of situational incompatibility and therefore part of what are classified as intervening variables.

These findings, therefore, provide evidence in support of Düvel's model, which suggests that the appropriate way of behaviour intervention is to focus on and change the intervening variables. In the case of promoting and uplifting the production efficiency of female farmers, it implies focusing extension inputs on the female farmers' needs, perception and knowledge. Once these have been identified through means of baseline surveys, purposeful behaviour intervention will be possible.

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