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RESPONSE OF FARMERS TO TECHNOLOGICAL TRANSFER IN THE METHYL BROMIDE PHASE-OUT PROGRAMME IN ZIMBABWE: THE FLOATING TRAY SYSTEM

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ABSTRACT

Sponsored by UNIDO, Zimbabwe in 2004, resolved to train about 28,033 tobacco farmers in five years so as to phase out the last 182 tonnes of methyl bromide then used in tobacco seedling production. The replacement technology chosen was the floating tray system. Floating tray system equipment for effective phase out was distributed to farmers with the overall objective of phasing out methyl bromide by 2009. Largely, most of the farmers were trained and equipment distributed for the effective phase-out as planned. This survey, carried out seven years later in 2011, intended to evaluate the adoption of the floating tray system by farmers. This information is required in order to assess the country's readiness for the 2015 banning of methyl bromide use in tobacco seedbeds. In addition, the survey sought to find out the role tobacco production played in deforestation and food security among other minor objectives. The survey utilized both qualitative and quantitative methods and was administered mainly on a face-to-face manner at the Boka and Tobacco Sales auction floors in Harare during the 2010/2011 selling season. In essence, the survey found out that the majority of the growers (44%) were males over 36 years old and that 76% were smallholder farmers farming on land below two hectares in size. Only 11% used the floating tray system although 61% had heard about the technology and could not use it citing the cost (48%), difficulties in procuring the substrate used in the technique, and lack of know how (39%) among other reasons. An alarming 74 % sterilised their seedbed by burning wood. Almost all farmers (91%) used the proceeds from the tobacco crop to support their maize crop. The few who used the floating tray system agreed that, it was easy (96%) and that an on-farm substrate would be better. In addition, they agreed that procurement of substrate was a problem (64%) and almost all (91%) wished to be trained in both the making of on-farm substrate from farm waste, and in the use of the floating tray system. Almost all used chemicals as a risk aversion technique. We concluded that, the floating tray system would be a recluse of a few after phase-out unless supportive measures are put in place. We also found that the use of indigenous wood in the production of tobacco would probably lead to deforestation.

Key Words: Deforestation, maize, ozone layer, tobacco

RÉSUMÉ

Sous l'appui de l'UNIDO en 2004, le Zimbabwe a résolu de former environ 28,033 cultivateurs du tabac pendant cinq ansafin d'éliminer les 182 tonnes de bromurede méthyleutilisées dans la production des semences du tabac. La technologie de remplacement choisie utilisait le système du plateau flottant. L'équipement de ce système était distribué aux fermiers avec pour objectif de mettre fin à l'utilisation du bromure de méthyleen 2009. La plupart des fermiers étaient largement formée et les équipementsdistribués pour l'élimination de la totalité de ce produit comme prévu. Cette étude d'enquête, conduite sept ans après en 2011 voudrait évaluer l'adoption du système du plateau flottant par les fermiers. Cette information est nécessaire afin d'évaluer si le pays est prêt àbannir l'usage du bromure de méthyle d'ici 2015 dans les pépinières du tabac. En plus, l'enquête a essayé de mettre en évidence le rôlejoué par la production du tabac dans la déforestation et la sécurité alimentaire parmi d'autres objectifs secondaires. L'enquête a utilisé des méthodes tant qualitatives que quantitatives, administrées face à face à Boka

et dans des places de vente à Harare au cours de la saison de vente 2010/2011. En effet, il découle de l'enquête que la majorité des cultivateurs du tabac (44%) était masculine sur un intervalle d'âge de 36 ans et que 76 %étaientconstitués de petits fermiers possédant moins de deux hectares de terres arables. Seuls 11 % utilisaient le système du plateau flottant bien que 61 % étaientinformés de la technologie et ne pouvaient pas l'utiliser, en avançant, parmi tant d'autres raisons,le coût (48 %), le manque de substrats utilisés dans cette technique, et le manque de connaissance sur utilisation de la technique(39 %). Un effectif alarmant de 74 % a déclaré que leurs pépinières sont stérilisées par brûlage du bois. Presque tous les fermiers (91 %) utilisaient le revenu de la culture du tabac pour soutenir leur culture de maïs. Ceux qui ont utilisé le système du plateau flottant ont déclaré que la technique était facile (96 %) et que le substrat fabriqué au champ serait meilleur. En plus, 64 % des répondants ont affirmé qu'il est difficile de se procurer les substrats et presque tous les fermiers (91 %) ont souhaité être formés sur la fabrication au champ des substrats à partir des refus de cultures et l'utilisation du système du plateau flottant. Presque tout le monde avait utilisé des produits chimiques comme une technique contre le risque. En conclusion, le système du plateau flottant pourrait constituer un reclus de peu de gens après éliminationà moins que les mesures de soutien soient mises en place. Il a été aussi trouvé que l'utilisation du bois indigène dans la production du tabac pourrait conduire à la déforestation.

Mots Clés: Déforestation, maïs, couche d'ozone, tabac

INTRODUCTION

Weeds, nematodes and soil borne pathogens are yield limiting in tobacco production. For years, methyl bromide fumigation had been the most important operation to control pests in tobacco production in Zimbabwe and indeed, elsewhere where tobacco is an important crop. However, in recent years methyl bromide (MB) was implicated in the depletion of the ozone layer and hence targeted for complete phase out by 2015, except for critical use exemptions (Bird, 1998). Amongst the economic and human costs of methyl bromide related depletion of the ozone layer are, compromised immune systems in animals and disrupted growth in some crop and forest plants (Miller, 1996; Bird, 1998). In 1994 Zimbabwe consumed 600 tonnes of MB, making it about the ninth highest user of this pesticide in the developing nations. Of this amount, 85% was for soil sterilization, 13% for post harvest, 2% for quarantine and pre-shipment and less than 1 % for other uses (Miller, 1996). Tobacco seedling production alone accounted for 83% of the methyl bromide used for soil treatment. Hence, from early 1990 to about 2005 intensive research effort targeted alternatives of methyl bromide and by far the largest proportion of these efforts were towards the floating tray system(Mazarura and Asher, 2011). In 2004 all the research was compiled into a user manual (Mazarura, 2004). Sponsored by UNIDO, the country in 2004 resolved to train just over 28 033 tobacco farmers in five years so as to phase out the last 182 tonnes of methyl bromide. Floating tray system equipment for effective phase-out of methyl bromide was distributed to farmers with the overall objective of phasing out methyl bromide by 2009. Largely, most of the farmers were trained and equipment distributed for the phase-out as planned. This survey, carried out seven years later in 2011, intended to evaluate the adoption of the floating tray system by farmers.

MATERIALS AND METHODS

In the 2010/2011 tobacco-selling season a survey was conducted at Boka and Tobacco Sales auction floors in Harare, Zimbabwe, for the entire selling season. The survey utilised both qualitative and quantitative methods and was administered mainly in a face-to-face manner at the various tobacco auction floors during the selling season from February (beginning of selling season) to August, 2011 (end of selling season). Farmers were randomly selected, 196 in total, as they came to sell their tobacco for the season. The survey targeted all farmers who were registered to grow tobacco for the 2010/2011 season. Thus, the survey did not discriminate between large scale and smallholder farmers as the issue of methyl bromide phase out cuts across size of production. Randomly selected farmers were given a questionnaire and were assisted in completing it. The floating tray system as described by Mazarura and Asher, 2011 is a

method of raising seedlings using a soilless technique. Seeds are sown in polystyrene trays that are floated in a pond of water. The required fertilizers are added to this water at stipulated times and the seedlings grown in the pond until they are transplanted into the field.

A chi-square analysis was carried out for the entire data set. Where possible qualitative data was given numerical coding before analysis.

RESULTS

The majority of tobacco farmers were male aged more than 36 years old (Table 1). A chi-square analysis showed that, considering all age groups, women constituted a small proportion of tobacco farmers (Table 1). However, most of the farmers were smallholder farmers farming on plots less than two hectares in size (Table 2). Of the smallholder farmers farming on less than two hectares of land, 63.3% were male while 12.3% were female (Table 2). In general, over 90% of the farmers used tobacco proceeds to purchase inputs for their maize crop

A majority of the farmers acknowledged that they were aware of the floating tray system. Of these, 50.9% were male while 10.3% were female. Those farmers who were aware of the floating tray system but did not practice it cited many constraints. A significantly large ($P<0.001$) number of farmers cited factors of production they did not specify and lack of knowhow as the main constraints that impeded them from practicing the floating tray system. A smaller proportion said they were just reluctant while another small proportion said they either could not access trays or gave no specific reason (Table 3). However, there was no association between constraint and age of respondent (Table 3).

When asked what problems they anticipated should they adopt the floating tray system, a significantly large number ($P<0.01$) cited inputs and transport to ferry inputs and produce as major barriers to adoption. A smaller proportion cited a fear of the associated pests and diseases as barriers (Table 4).

A significant ($P < 0.001$) number of farmers, who did not use the floating tray system, sterilized

TABLE 1. The age and gender distribution of tobacco farmers who responded to the survey

Age (years)	Gender		Total
	Male (%)	Female (%)	
< 20	0.5	0.5	1.0
20-25	10.2	1.5	11.7
26-35	27.6	6.1	33.7
>36	44.4	9.2	53.6

χ^2 (1, N = 174) = 1.88, p = .60)

TABLE 2. The relation of land size to the gender of the farmers who responded to the survey

Size of land (ha)	Gender		Total (%)
	Male (%)	Female (%)	
<2	63.3	12.3	75.5
3-5	11.7	3.1	14.8
6-10	5.1	1.0	6.1
>10	2.6	1.0	3.6

χ^2 (4, N = 174) = 1.04, p = .90)

TABLE 3. Reasons give by each age group for not practicing the floating tray system

Reasons	Age (years) of respondents				Total
	<20	20-25	26-35	>36	
Affirmation (%)					
Lack of knowhow	0.6	6.9	10.9	20.7	39.1
Production constraints	0	3.4	17.8	26.4	47.7
Just reluctance	0	0.6	2.9	5.2	8.6
Access to trays	0.6	0	0.6	1.7	2.9
No idea	0.6	0.6	0.6	0	1.7

χ^2 (12, N = 196) = 19.04, p = .087)

Comparison	P
Lack of knowhow, Production constraints > Just reluctance, Access to trays, No idea	0.001
Just reluctance > Access to trays	0.002

TABLE 4. Problems anticipated by farmers if they are to adopt the floating tray system

Problem	Respondents (%)
Inputs	33.2
Pests and diseases	7.1
Storage	5.6
Climatic limitation	2.0
Transport	52.1

Comparison	P
Inputs, Transport > Pests and diseases, Storage, Climatic limitation	0.01

TABLE 5. Source of seedlings and method used to sterilize seedbed site by knowledge of the floating tray system

Method used/ seedling source	Float system knowledge (%)		Total
	Yes	No	
Burn using wood	43.1	31.0	74.1
Used chemicals	14.9	6.9	21.8
Bought seedlings	2.9	1.1	4.0

χ^2 (15, N = 178) = 131.60, p = .0001)

their seedbeds by burning wood from local forests, while a smaller proportion used chemicals (Table 5). On the other hand, some farmers bought float seedlings. A significantly (P<0.0001) large number of non-floating tray system users required a seedbed culture training, while a large proportion of floating tray system users required a full training including substrate culture (Table 6).

To aid analysis, for each aspect of the floating tray system, the response of the farmers who practiced the floating tray system were aggregated into two groups. One group comprised of those farmers that responded by disagreeing strongly plus those who disagreed and the ones who did not know and the other group of those who agreed plus those who agreed strongly (Table 6). The two groups were

TABLE 6. Type of assistance required by farmers

Assistance area	Non-float tray users (%)	Float tray users (%)
Seedbed culture training	28.2	9.1
Full including substrate	65.5	81.1
No idea	6.3	9.1

χ^2 (21, N = 178) = 10.91, p = .0001)

TABLE 7. The response of float tray users to specific aspects of the technology

Float system aspect	Response (%)		P
	(Disagree strongly+ Disagree + Don't know)	(Agree + Agree strongly)	
The system is easy to use	4.5	95.5	0.001
Pine bark is a major challenge	13.6	63.7	0.001
On-farm substrate is best	4.5	95.5	0.001
I need training to make my own substrate	9.1	90.9	0.001
I have been trained to sterilize trays	81.9	18.1	0.001
Float seedlings are uniform in size	18.2	81.9	0.001
Float seedlings transplant better	4.5	95.5	0.001
I also use chemicals to lessen risk	18.0	81.8	0.001
I will continue to use this system	23.6	76.4	0.001

compared. A significantly large (P<0.001) number agreed that the technique was easy to use, gave uniform seedlings, and that the seedlings established better after transplanting. In addition, farmers agreed that pine bark was not easily availability and that a locally available substrate would be preferred. Many of the farmers were willing to be trained to make their own substrate (Table 7). In addition, 63.7 % had not been trained in the use of the floating tray system.

DISCUSSION

These results showed that tobacco farming was male dominated, at almost all age groups. This finding was anticipated since tobacco farming has been male-dominated for years, perhaps because of the high labour requirement in its production. Our finding that the majority of growers were adult males confirms similar findings, that there were fewer young farmers in tobacco production, by Capehart (2004). However, the entry of women, although recent, will increase in this important commercial crop in the country. This must be because the crop has become a major commercial crop of late, providing the farmer with a readily available, very sophisticated and well managed marketing system. Although we did not look at the implication of this shift from food crops to a non-food crop by women, we agree that this raises fears that this shift might lead to food insecurity as women neglect food crops (Muwanga-Bayego, 1994). Interestingly, a majority of farmers used proceeds from tobacco to support maize, which is a staple food in the region. It is conceivable that this may somewhat lessen the negative impact of the shift to a non-food crop by women. Nevertheless, the survey did not measure the proportion of total proceeds that was allocated to the inputs for maize production. However, Peters and Herrera (1994) showed that tobacco households did not displace maize below a certain level. Our findings that the majority of tobacco growers were smallholder farmers working on land less than two hectares is typical in the region (Jayne *et al.*, 2003).

Since the training had targeted 28, 033 farmers, it is conceivable that many farmers might have heard something about the floating tray system.

This testifies to the effectiveness of the initial outreach activities carried out some years ago. That more males than females knew about the floating tray system was perhaps because males dominated the tobacco industry. As expected, many farmers did not practice the system because they lacked knowledge about this foreign technique. This implies a strong need to train farmers on the use of the floating tray system and related technologies like substrate making. Farmers were also very clear on what they considered barriers to the adoption of the floating tray system. However, the problems anticipated by the farmers were the usual problems faced by the vast majority of smallholder farmers such as input availability, a reluctance to invest in new technology, risk aversion and others (Fischler, 2010)

Though alarming, the finding that tobacco depletes wood is well documented in Africa, although this is usually with regard to curing (Chapman, 1994; Muwanga-Bayego, 1994). It is our fear that the use of wood in seedbed sterilization will lead to further depletion of trees. This is bound to have a very negative impact on the environment, including climate change (Masau, 2012).

An major encouragement of replacing methyl bromide with the floating tray system was the finding that those who practiced the float tray system found it easy and attested that it produced superior seedlings (in terms of uniformity of size) which were more drought resistant confirming earlier findings by Mazarura (2004). Since pine bark is found more than 200-500 km from the tobacco growing areas, it was anticipated that smallholder farmers would face challenges in procuring it and would prefer a locally available substrate likely to be created from farm waste. Finally, the farmers indicated a willingness to be trained in both the float system technique and substrate production.

This survey documented for the first time that tobacco was a food security crop in the smallholder sector in Zimbabwe and probably in other countries as well, although it is debatable that this is a good thing in the end. In this role, money earned from tobacco is used to fund maize production. However, some have shown that tobacco production can lead to food insecurity (Rahman, 2011).

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this study found a need for training in order to sustain the floating tray technology among smallholder farmers. This training should include substrate making in addition to the usual aspects of producing seedlings using the floating tray system. The role of tobacco as an indirect food crop was confirmed in this study. This probably means more females will enter the market since women play a very important role in food security in developing countries. However, this trend may lead to marginalisation of other important food crops. Finally, this study confirmed the detrimental side of tobacco production in smallholder cropping systems. This implies that the crop has the potential to cause massive deforestation and environmental degradation unless communities set up wood lots. Further study is required to unravel the implications of this crop on food security.

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