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EXTENSION SUPPORT FOR GRAIN CROP PRODUCERS UNDER CLIMATE VARIABILITY SCENARIO: IMPLICATIONS FOR EXTENSION MANAGEMENT IN LIMPOPO PROVINCE, SOUTH AFRICA

David Blay Afful✉, Kingsley Kwabena Ayisi

University of Limpopo

Abstract. The paper examined how the farm management support provided by public extension to mitigate the effects of climate variability influences farmers' production, and whether this support considers farmers' capital assets. Both probability and non-probability sampling procedures were used to select districts, municipalities and farmers from 20 villages of Limpopo province, South Africa in January, 2014. Semi-structured questionnaires were used to collect data from field-level extension agents and smallholder grain farmers. The most common climate variability coping strategy promoted by many agents was climate-smart agriculture practices. This strategy was applied by most users and non-users of extension support. The most popular channel used by agents to communicate information to farmers was farm visits. There were indications that agents did not consider producers' capital assets in their choice of channels to communicate information to producers. Results further indicate that extension support, including climate variability information, contributed to increased crop yields, albeit small. It is recommended that field trials be done to ensure proper application of climate variability coping measures. More use of mass media and group methods to supplement farm visits is recommended.

Key words: capital assets, farm management support, mass media, farm visits, group methods

INTRODUCTION

Broad political and scientific consensus exist that climate change and variability is happening and will continue well into the future (Christensen et al., 2007). Overall, assessments that include future populations and alternative future socio-economic conditions have demonstrated that climate change and variability would benefit the developed countries more than the developing countries (Gregory et al., 2005 citing Fischer et al., 2005, 2002 a,b). In southern Africa, climate change and variability is among the most frequently cited drivers of food insecurity (Gregory et al., 2005). Some of the effects of the climate change and variability phenomenon include substantial crop reductions (up to 30 percent by 2030 for maize production) (Kurukulasuriya and Mendelsohn, 2006; Lobell and Field, 2007) and water supply problems (Sally and Kamire, 2002; Madzwamuse, 2010). Pest infestations often coincide with changes in climatic conditions, such as early or late rains, drought, or increases in humidity, which themselves can reduce yields. In these circumstances, attributing specific losses to pests can be difficult. Studies however, suggest that climate change is likely to increase the spread of plant pathogens spread by aphid vectors in a number of crops (Harrington et al., 2007) which could ultimately reduce yields.

✉PhD, David Blay Afful, Department of Agricultural Economics and Animal Production, University of Limpopo Private Bag X1106, Sovenga, 0727, South Africa, e-mail: david.afful@ul.ac.za

Reduced net farm incomes have been reported as well (Kurukulasuriya and Mendelsohn, 2006; Nielson et al., 2010). Limpopo, together with the North-West, the Free State and Gauteng are among the provinces in South Africa predicted to be hardest hit in terms of crop production by climate change and variability by 2080 (Turpie and Visser, 2012).

To continue to be relevant to their clients, Agricultural Extension organizations such as the Kenyan Agricultural Extension Services, have revised their policies to adapt their services to climate change and variability (Chinwe et al., 2009). The importance of Extension in change and as a change agency has been ascertained by Warner and Christenson (1984). The important role of agricultural extension in agricultural development, mitigating the effects of climate change and on production is widely acknowledged (Newton and Yee, 2007; Anderson, 2008 citing Gray, 2006; Davis, 2009; Wang, 2014). Agricultural extension, therefore, has a role to play in ensuring that smallholder producers have up-to-date scientific information and skills for productive enterprises in the current era of climate change and variability. Agricultural extension features prominently in the South African government's Integrated Food Security programme as the agency mandated to respond to the needs of small farmers (Department of Agriculture, 2002).

The effectiveness of the extension system however, in fostering capacity building, technological adoption and ultimately, improved agricultural outcomes depends on key factors relating to the advisory methods used, the governance, capacity and management structures of the Extension system, as well as underlying contextual factors such as the policy environment, market access, characteristics of beneficiary communities and weather conditions (Waddington et al., 2010).

Effective extension support for smallholder producers within the current atmosphere of climate change and variability therefore, requires that extension policy makers and managers have adequate knowledge of the characteristics of farmer beneficiaries and the appropriate extension intervention methods/channels needed to provide support for these beneficiaries. This will help improve the effectiveness of the extension delivery system and also farmers' productivity.

Against this background, the central research question in this study relates to how public extension climate variability farm management support influences smallholder grain farmers' production and whether this support considers producers' capital assets?

Specific research questions to be addressed include:

- What climate variability coping measures are public extension agents promoting among smallholder farmers to support their crop production?
- Do the channels/methods used by Extension agents to provide climate change information to support farmers' production system consider farmers' capital assets?
- How does the current Extension support impacts on farmers' crop production?

METHODOLOGY

Both probability and non-probability sampling procedures were used to sample districts, Local Agricultural Offices (LAO's), and farmers from 20 villages of Capricorn and Sekhukhune districts of Limpopo province, South Africa in January 2014. Semi-structured questionnaires were used to collect data from 194 smallholder maize and sorghum farmers in 20 villages spanning four LAO's and two districts. Data collected include producers' crop yields, capital assets, and climate variability information. Twenty-four field-level extension agents from four LAO's where the farmers were selected, were also interviewed. Data collected from agents include demographic information, extension methods used and climate variability coping and adaptation strategies promoted. Climate variability defined as the yearly fluctuations of climate above or below a long-term (30yrs) average value (Disne, 2011). Data collected from farmers' perception of climate events within the last 10 years of the study led to the focus on climate variability as opposed to climate change, which is long-term, gradual climate events and difficult to perceive without scientific records (Disne, 2011). Coping strategies were defined as responses needed in the short term to deal with climate stressors (Warner, van der Geest, & Kreft, 2013 citing Birkman, 2011) while adaptation strategies were defined as responses needed in the long-term to deal with climate stressors (Warner, van der Geest, & Kreft, 2013 citing Birkman, 2011). The assessment of the effect of public extension support including climate variability information was made with regard to respondent's food production. This was done by comparing the crop yields (ton/ha) obtained by respondents who received some public extension service including climate variability

information and those who did not, in the year before the study. Data analysis tools used were descriptive and inferential statistics. The computer program used to run the analysis was SPSS.

RESULTS

The findings of the field study are presented in this section. Table 1 provides some of the farmers' capital assets thought to have a bearing on their crop production under the current climate variability environment. Regarding physical capital, most respondents had access to or owned communication devices such as cell phone, radio and television; very few had access to or owned of computers. Very few respondents also applied irrigation.

Frost (1996) defines functional literacy as the ability to read, write and speak with understanding, at a level that enables one to participate effectively in the community and the workplace. Farmers' ability to read and write (literacy) and also apply simple numerical concepts (numeracy), such as addition, multiplication, division and subtraction were assessed by the number of years of formal schooling. According to Frost (1996) functional literacy is broadly equivalent to eight years of formal schooling in the South African context. This view is similar to that of Swanepeol et al. (2008) citing

Table 1. Farmers' capital assets
Tabela 1. Zasoby kapitałowe rolników

Asset – Zasób	Number Liczba	%
1	2	3
Physical capital – Zasoby fizyczne		
Ownership of cell phone – Telefon komórkowy (N = 193)	178	92
Ownership of radio – Radio (N = 193)	116	60
Ownership of television set – Telewizor (N = 193)	162	84
Personal computer – Komputer osobisty (N = 193)	14	07
Access to irrigation water, always or sometimes (N = 192) Dostęp do nawadniania, zawsze lub czasami (N = 192)	28	15
Human capital – Zasoby ludzkie		
Number of years of formal schooling (median = 8 years; skewness = –.106; more than 8 years (secondary education)) (N = 153) Liczba lat formalnej edukacji (średnia = 8 lat; skośność = –0,106; powyżej 8 lat (szkoła średnia)) (N = 153)	74	48
Number of climate variability workshops/training attended 2003–2013 (median = 2; skewness = 2.708; two or more workshops) (N = 27) Liczba ukończonych warsztatów dotyczących zmian klimatycznych/szkoleń w latach 2003–2013 (średnia = 2; skośność = 2,708; dwa lub więcej) (N = 27)	15	56
Number of years of farming in the area (median = 15 years; skewness= 1.097; 15 or more years of farming in the area) (N = 191) Liczba lat prowadzenia gospodarstwa (średnia = 15 lat; skośność = 1,097; 15 lat lub więcej) (N = 191)	95	50
Awareness of climate variability: – Świadomość zmian klimatycznych:	–	–
Trend in timing of rainfall – Trendy w rozkładzie czasu opadów (N = 193)	–	–
Generally too early – Ogólnie za wcześnie	65	34
Generally too late – Ogólnie za późno	123	64
No change – Brak zmian	05	03

Table 1 cont. – Tabela 1 cd.

1	2	3
Trend in intensity of rainfall – Trendy w intensywności opadów (N = 193)	–	–
Rains a lot in a few months – Zbyt mało opadów w ciągu kilku miesięcy	145	75
Fairly distributed over rainfall season – Rozłożenie opadów w sezonie	46	24
No change – Brak zmian	02	01
Trend in temperature changes – Trendy zmiany temperatury (N = 184)	–	–
Hotter periods – Okresy bardziej gorące	173	94
Colder periods – Okresy chłodniejsze	05	03
No change – Brak zmian	06	03

Source: own elaboration.
Źródło: opracowanie własne.

Erasmus et al. (2006) who refer to illiteracy in South Africa as educational level lower than grade seven level of education. The findings about respondents' (N = 194) human capital indicated that slightly less than half of the respondents (48%) had completed eight years of formal schooling. Very few respondents (14%) had attended any climate change and variability workshops etc. in the last 10 years of the survey. A slight majority (56%) of this number (n = 27) had attended two or more of such workshops in that period while the rest (44%) had attended only one workshop in the same period. With regard to farming experience, half of the respondents (50%) have been farming for fifteen or more years.

Findings on assessment of farmers' (N = 193) awareness of climate variability showed that most respondents were aware of the variability in the climate in the period of the study. More than half of the respondents (64%) were aware that the rains came too late in the last 10 years of the study. Furthermore, most respondents (75%) (N = 184) had observed that it generally rained a lot within a short period of time while a vast majority (94%) said that there were more hotter days in the last 10 years of the study compared with the past years.

Results from public extension support for farm production showed that a small percentage of respondents had access to public extension support including climate variability information (37%) (N = 193). Maize producers received three visits compared with approximately two for sorghum farmers in the last planting season (2012/2013) before the study.

All extension-support recipients indicated that compared with other channels, farm visits was the channel through which they received farm management support including climate variability information (Table 2). Farm visits was followed by farmers' days as the next popular channel, though mentioned by only 35% of respondents. Contrary to what respondents said, the channel mentioned by most agents (88%) for disseminating information to farmers, was group discussions; this was followed by farm visits (76%). All other channels were either mentioned by agents but not reciprocally mentioned by farmers or mentioned either by a small number of farmers or agents or not mentioned at all by agents and farmers.

Coping strategies promoted and used by respondents

Most extension agents promoted climate-smart agriculture practices (CSA) such as the use of fertilizer/manure, drought-resistant varieties and early or late planting or late and early-maturing crop varieties amongst producers (Table 3). Slightly more extension-support recipients (75%) compared with non-recipients (67%) used conservation CSA as coping measures against climate variability (Table 4). Similarly, there were two to three times more extension-support recipients than non-recipients who used early or late planting; early or late maturing varieties, drought-resistant varieties, fertilizer/manure; about 10 times more users of extension support than non-users applied some form of irrigation.

Table 2. Information channels used by public extension agents and respondents
Tabela 2. Kanały informacji używane przez przedstawicieli pomocy publicznej i respondentów

Channel/method Kanał/metoda	Percentage use Użycie procentowe	
	Farmer Gospodarz	Extension agent Przedstawiciel pomocy rozszerzonej
Mass media – Media masowe		
Television – Telewizja	72 (15)	25 (28)
Radio – Radio	72 (19)	25 (60)
Leaflets – Ulotki	72 (17)	25 (32)
Newspaper – Gazety	–	25 (16)
Group methods – Metody grupowe		
Farmers' Days/Information Days	72 (35)	25 (12)
Dni gospodarza/Dni informacji		
Training classes – Zajęcia szkoleniowe	72 (19)	25 (32)
Meetings – Spotkania	72 (01)	25 (08)
Lectures – Wykłady	–	25 (32)
Symposia – Sympozja	–	25 (08)
Workshop – Warsztaty	–	25 (08)
Group discussion – Grupy dyskusyjne	–	25 (88)
Lectures – Odczyty	–	25 (32)
Individual methods – Metody indywidualne		
Farm visits – Odwiedziny rolnika	72 (100)	25 (76)
Cell phone messages – Wiadomości SMS	–	–

Source: own elaboration.
Źródło: opracowanie własne.

Effect of public extension support

The effect of public extension support was assessed in one way by a comparison of extension-support recipients and non-recipients of their awareness-knowledge of climate variability issues, the use of coping strategies and the number of climate variability workshops attended. The findings (Table 5) showed that public extension agents made a difference in farmers' knowledge on the intensity of rainfall in the current era of climate variability ($p = 0.000$). Similar significant influences were observed regarding farmers' use of late or early planting or use of late or early maturing variety, drought-resistant varieties, wetlands, fertilizer/manure, irrigation and number of climate change training workshops attended.

The other assessment of the effect of public extension support including climate variability information was made with regard to respondents' food production. This was done by comparing the crop yields obtained by respondents who received some public extension service including climate variability information and those who did not, in the last year before the study. The results of yield data from respondents

Table 3. Coping and adaptation strategies promoted by public extension
Tabela 3. Strategie adaptacji i radzenia sobie ze zmianami klimatycznymi zalecane w ramach pomocy publicznej

Strategy Strategia	Percentage of respondents Procent respondentów
Coping strategy Strategia radzenia sobie	
Climate-smart agriculture (n = 24) Prowadzenie gospodarstwa z uwzględnieniem warunków klimatycznych (n = 24)	67
Use of improved/certified/hybrid seeds (n = 24) Korzystanie z nasion udoskonalonych/certyfikowanych/hybrydowych (n = 24)	21
Do climate change awareness campaign (n = 24) Kampanie uświadamiające o zmianach klimatycznych (n = 24)	08
Encourage farmers to listen to and /or watch television broadcasts on climate change (n = 24) Zachęcanie rolników do słuchania/oglądania audycji poświęconych zmianom klimatu (n = 24)	04
Promote water harvesting (n = 24) Promowanie zbierania wody (n = 24)	08
Rehabilitate project structures to prevent strong winds (n = 24) Wznowienie realizacji projektów mających na celu zapobieganie silnym wiatrom (n = 24)	04
Application of pesticides (n = 24) Stosowanie pestycydów (n = 24)	04
Adaptation strategy Strategia adaptacyjna	
Discourage deforestation (n = 17) Zapobieganie wylesianiu (n = 17)	35
Plant indigenous trees/agro-forestry (n = 17) Zalesianie rodzimymi drzewami/uprawy rolno-leśne (n = 17)	12
Control invasive, alien plants (n = 17) Kontrolowanie obcych roślin inwazyjnych (n = 17)	12
Control veld fires (n = 16) Kontrolowanie wypalania (n = 16)	06
Discourage planting of exotic plants (n = 16) Zapobieganie uprawom roślin egzotycznych (n = 16)	06
Construction of irrigation dams (n = 17) Budowa tam nawadniających (n = 17)	06

Source: own elaboration.
Źródło: opracowanie własne.

are provided in Tables 6 and 7. The effect of the use of public extension on farmers' yields is evident; there were more non-extension recipients than extension-support recipients in the lower yield category (Table 6). On the other hand, there were more extension-support recipients than non-recipients in the higher yield categories; the mean yield of extension-support recipients (0.845 ton/ha) was higher than non-extension recipients (0.548 ton/ha) (Table 7). The differences in respondents' mean yields (Table 6) were subjected to an independent samples t-test to assess the significance. The difference was significant but small ($p = 0.002$; two-tailed; eta squared = 0.05) (Pallant, 2007 citing Cohen, 1988).

Table 4. Crop production coping strategies used by respondents
Tabela 4. Strategie upraw stosowane przez respondentów, uwzględniające zmiany klimatu

Coping strategies Strategie	Respondents (%) Respondenci (%)	
	Extension Rozszerzone	No extension Nierozszerzone
Early or late planting; early or late maturing varieties Rośliny wczesne lub późne, użycie odmian wcześnie lub późno dojrzewających	69 (70)	119 (22)
Correct seeding rate/weeding Zastosowanie odpowiedniego wskaźnika zasiewu/odchwaszczania	69 (33)	119 (33)
Conservation agriculture* Ochrona rolnictwa*	69 (75)	118 (67)
Use of drought-resistant varieties Stosowanie odmian odpornych na suszę	68 (57)	119 (18)
Use of wetlands Wykorzystanie mokradeł	69 (2)	118 (2)
Application of fertilizer/manure Stosowanie nawozu/obornika	69 (65)	119 (26)
Water harvesting Zbieranie wody	68 (2)	119 (8)
Use of irrigation Stosowanie nawadniania	69 (22)	119 (2)

*Includes minimum or no tillage, crop rotation, cover cropping, soil mulching, etc.
Numbers in brackets are percentages.
Source: own elaboration.
*Obejmuje orkę minimalną lub brak orki, plodozmian, rośliny okrywowe, mulczowanie gleby itd.
Liczby w nawiasach oznaczają wartości procentowe.
Źródło: opracowanie własne.

Table 5. Influence of use of public extension support on respondents' awareness knowledge of climate variability, use of coping strategies and number of climate variability workshops attended
Tabela 5. Wpływ wykorzystania rozszerzonej pomocy publicznej na poziom wiedzy dotyczącej zmienności klimatu, stosowania strategii radzenia sobie ze zmianami klimatycznymi i liczbę ukończonych warsztatów

Area of influence Obszar wpływu	χ^2	*p*	*n*	df
1	2	3	4	5
Awareness area Obszar świadomości				
Trend in timing of rainfall Trendy w rozkładzie czasu opadów	0.687	0.709	193	2
Trend in quantity of rainfall Trendy w wielkości opadów	2.964	0.227	192	2
Trend in intensity of rainfall Trendy w intensywności opadów	7.412	0.006*	193	1

Table 5 cont. – Tabela 5 cd.

1	2	3	4	5
Trend in temperature changes Trendy w zmianie temperatury	3.643	0.162	184	2
Use of coping strategies Wykorzystanie strategii radzenia sobie ze zmianami klimatycznymi				
Late or early plant or use of late or early maturing variety Rośliny wczesne lub późne, użycie odmian wcześnie lub późno dojrzewających	41.663	0.000*	188	1
Use of correct seeding rate Zastosowanie odpowiedniego wskaźnika zasiewu	0.006	0.937	188	1
Conservation agriculture Ochrona rolnictwa	1.469	0.225	187	1
Drought-resistant varieties Odmiany odporne na suszę	31.308	0.000*	187	1
Wetlands Mokradła	21.167	0.000*	187	1
Fertilizer/manure Nawóz/obornik	28.820	0.000*	188	1
Water harvesting Zbieranie wody	3.173	0.075	187	1
Irrigation Nawadnianie	21.365	0.000*	188	1
Number of workshops attended Liczba ukończonych warsztatów	10.012	0.007*	193	2

Source: own elaboration.
Źródło: opracowanie własne.

Table 6. Percentage distribution of respondents' crop yields according extension use
Tabela 6. Rozkład procentowy korzystania z rozszerzonej pomocy według wydajności upraw

Yield – Wydajność (t/ha)	Use of Public Extension Wykorzystanie pomocy publicznej	
	Used (N = 68) Wykorzystano (N = 68)	Not used (N = 113) Nie wykorzystano (N = 113)
Less than 1 Poniżej 1	66.0	79.0
1–2.99	32.0	20.0
3–4.99	1.5	0.9

Source: own elaboration.
Źródło: opracowanie własne.

Table 7. Mean yield (t/ha) differences according to extension support
Tabela 7. Średnia wydajność upraw (t/ha) a rozszerzona pomoc

Use of public extension for climate variability information Korzystanie z pomocy publicznej w zakresie informowania o zmianach klimatu	Number Liczba	Mean Średnia	Standard deviation Odchylenie standardowe
Received this information Po otrzymaniu tej informacji	68	0.845	0.747
Did not receive this information Bez tej informacji	113	0.548	0.607

Source: own elaboration.
Źródło: opracowanie własne.

DISCUSSION

Coping measures promoted and farmers' use thereof

The findings on extension support including promotion of climate variability coping measures such as CSA to reduce the negative effects of climate variability especially, for smallholder farmers are consistent with literature (e.g. Davis, 2009; Chijioke et al., 2011). The promotion of CSA by agents and the use of this practice by most farmers in this study, suggest that both agents and farmers are aware of and, believe in the efficacy of climate variability coping strategies such as CSA, to improve crop yields even without irrigation. This is significant in the sense that the practice has been found to increase maize yields without irrigation (Knowler and Bradshaw, 2007 citing Sorrenson et al., 1998; Boateng, 2011; Marongwe et al., 2011).

Farmers' capital assets and extension channels used

Physical capital

The relationship between farmers' adoption decision process and the use of particular extension communication channels has been widely discussed (Rogers, 2003; Allard, 2004; Onasanya et al., 2006). Literature provides evidence that group methods require moderate amounts of extension funds to produce the highest amount of adoption of practices (Wilson and Gallup, 1955). It is also indicated that mass media are the cheapest form of information diffusion per person reached with the potential to reach widespread, diverse audiences (Wilson and Gallup, 1955; Heong et al., 1998; Bentley et al., 2003; Kiplangat, 2003). In view of our survey respondents' access to or ownership of radio, television and cell phone, the dominant use of individual methods such as farm visits, by most agents as reported by most respondents, suggests that agents do not consider respondents' available assets in their use of channels for effective and efficient communication of farm management information. The importance of personal contact in knowledge dissemination is acknowledged (RUSH, 1996 citing Crandall, 1989; Hoag, 2005). The problem, however, is that farm visits, take up a lot of extension workers' time and also financial resources to accomplish (Wilson and Gallup, 1955; Dinar, 1996). The small number of visits per year recorded in our study is therefore, not surprising but consistent with the trend of extension farm visits in developing countries. Akpalu's (2013) study in Limpopo province made a similar finding. Our finding has a number of implications for extension management. The high cost translates into a few number of visits made to producers. Few visits result in limited contact between agents and producer and therefore, less farmer exposure to more, current farm management support including climate variability information which has the potential to improve their production.

Human capital

The findings in our study indicate that in the delivery of current farm management information including climate variability material, most extension agents are not exploiting respondents' ability to read literature such as leaflets. This situation does not reflect the positive influence of education on the adoption of innovations as recorded in literature (Knowler and Bradshaw, 2007).

Social capital

This study judged the current level of public extension support to farmers' production in one way based on the number of farmers that had contact with the extension agent. The finding recorded here in our study regarding the small number of respondents who had contact with Extension agents as well as their few number of contacts with agents concur well with literature. Jiggins (1997) for example, indicate that extension agents reach only 30% of farmers in developing countries. This assertion is supported by the findings of Ndoh et al., (2015) in Cameroon; and of Akpalu (2013), Maponya et al. (2013) in Limpopo province and Farrington (1979) in Sri Lanka.

The implication of our finding is that few farmers are likely to adopt innovative farm management practices including climate variability practices that are promoted by the extension agent. This is against the backdrop of a close relationship between contact with extension teaching or exposure to extension information and the adoption of recommended practices (e.g. Lin et al., 2008; UNFCCC, 2008). The non-adoption of innovative farm management practices translates into poor crop productivity for most farmers as recorded in our study.

Effectiveness of extension support – yield of respondents

This study also judged the current level of extension support to farmers based on the influence of the support including climate variability information on farmers' crop yields (Tables 6 and 7). Our finding in this regard is consistent with literature of the positive effect of such support on crop yields (e.g. Asres et al., 2013; Bruce et al., 2014). This positive effect notwithstanding, the low yields (less than 1 ton/ha) obtained by most respondents as well as the small yield increase of extension-support recipients over non-recipients are however, worrisome. According to K. Ayisi (pers. comm., July, 2014), CSA maize field trials under similar conditions in one of the LAO's (Makhuduthamaga) in the study areas indicate a potential yield of 5 tons/ha. The implication of our finding regarding agents' promotion of coping strategies, is that, there could be incorrect application of the coping strategies regarding CSA by producers.

CONCLUSION

Extension support for farmers' production generally aims at improving crop production, which should finally translate into increased profits. In answering the research questions set out at the beginning of this study, it can be said that extension agents' in the study areas generally promote climate variability coping measures, mainly, CSA. The latter makes a contribution to farmers' crop yields albeit, small even though farmers indicated using such climate-smart agriculture practices. Furthermore, our finding indicates that most Extension agents use farm visits, according to farmers, as the most dominant extension channel through which to communicate farm management support including climate variability information. Agents' use of communication channels, most of the time, do not consider producers' capital assets which have the potential to improve the effectiveness and efficiency of the communication strategy.

RECOMMENDATIONS

Extension managers generally account for the effect to which they put extension funds. The immediate result of extension efforts usually relates to producers' productivity. Improving producers' crop yields as has been reported in this study, could be achieved through adaptive field trials involving agents, farmers and scientist to ensure proper application of CA. The complexity of CA management packages requires that this kind of research is undertaken to assess the local ecological and socio-economic conditions under which CA is best suited for smallholder farming.

Extension Managers also have to ensure that the channels used in extension communication plans of field-level agents consider and take advantage of the farmers' capital assets and the potential of these assets for effective and efficient communication of farm management information. This is especially important in this era when extension organizations in many countries world-wide face tight budgets.

Given the financial constraints that generally face most extension organizations, especially in developing countries including South Africa, managers of field-level extension agents of the Limpopo Department of Agriculture Extension service should consider ensuring that agents' use of communication channels is more cost-efficient. This could be achieved by ensuring that agents supplement farm visits with more effective mass media educational broadcasts and use of more group methods as extension educational tools. Radio broadcasts could be linked to producers' cell phones to provide them with

regular and important short messages on farm management including climate variability information.

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ROZSZERZONE WSPARCIE DLA ROLNIKÓW PROWADZĄCYCH UPRAWĘ ZBÓŻ PRZECIWDZIAŁAJĄCE EFEKTOM ZMIAN KLIMATYCZNYCH: PRZESŁANKI DO STOSOWANIA ROZSZERZONEGO ZARZĄDZANIA W PROWINCJI LIMPOPO W AFRYCE POŁUDNIOWEJ

Streszczenie. W artykule zbadano, jak wsparcie w zarządzaniu gospodarstwem – w ramach pomocy publicznej służącej złagodzeniu skutków zmienności klimatu – wpływa na produkcję w gospodarstwach i czy przy jego udzielaniu uwzględnia się zasoby kapitałowe tych gospodarstw. Do badań przeprowadzonych w styczniu 2014 roku wybrano powiaty, gminy i rolników z 20 wsi w prowincji Limpopo w Afryce Południowej, przy zastosowaniu doboru losowego i nielosowego. Do zbierania danych posłużyły specjalnie przygotowane kwestionariusze, wypełnione przez przedstawicieli terenowych i rolników prowadzących małe gospodarstwa rolne. Najczęściej wskazywaną przez przedstawicieli terenowych strategią radzenia sobie ze zmianami klimatycznymi było stosowanie metod prowadzenia gospodarstwa odpowiednio uwzględniających te warunki. Wykorzystywało ją większość osób, zarówno korzystających, jak i niekorzystających ze wsparcia. Przedstawiciele terenowi najczęściej przekazywali informacje bezpośrednio podczas wizyt w gospodarstwach. Wskazywano, że przedstawiciele nie uwzględniali zasobów kapitałowych gospodarstw przy udzielaniu wsparcia producentom rolnym. Wyniki wskazują również, że udzielane wsparcie uwzględniało przekazywanie informacji o zmianach klimatycznych mających wpływ na uprawy polowe, aczkolwiek w niewielkim stopniu. Zaleca się przeprowadzenie badań terenowych w celu zapewnienia właściwego stosowania strategii radzenia sobie ze zmianami klimatycznymi. Uzupełnieniem tego może być wykorzystanie mediów masowych i metod grupowych.

Słowa kluczowe: zasoby kapitałowe, wsparcie w zarządzaniu gospodarstwem, media masowe, wizyty w gospodarstwach, metody grupowe

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