Section 1: Data analysis

Primary data were coded by assigning an algebraic value for statistical analysis purposes in the Statistical Package for the Social Sciences (SPSS) version 23.0. Descriptive statistics were used for the analysis of the demographic characteristics of the household heads. A frequency analysis was used to analyse the types and sources of seeds grown, perceived impacts, challenges, and the determinants of the adoption of improved seed varieties in the study area. The factors determining the adoption of the improved maize seed varieties were identified using a binary logistic regression model, with the adoption of improved maize seed varieties as the dependent variable against the selected demographic characteristics of the household heads as the explanatory variables (Supplementary table 1). Selection of the possible demographic characteristics that are more likely to have significant effects on the adoption of improved seed varieties was based on the literature.[1-5] A similar set of statistics has been used successfully in previous studies to investigate the key barriers and determinants for the adoption of improved seed varieties in smallholder settings.[2,3,5,6]

Supplementary table 1: Description and expected effects of the explanatory variables used in a binary logistic regression model

Independent variable	Description and measurement type	Variable type	Expected outcome[a]
Gender	Male (1/0)	dummy	+
Age	Age of the farmer (years)	continuous	+
Level of education	Level of education (years)	continuous	+
Occupation	Own or family farming (1/0)	dummy	+
Off-farm income	Household off-farm income (ZAR)	continuous	+
On-farm income	Household on-farm income (ZAR)	continuous	+
Access to media	Access to climate information (1/0)	dummy	+
Distance to market	Distance to market (km)	continuous	-
Ownership of transport	Ownership of transport (1/0)	dummy	+
Ownership of land	Ownership of land (1/0)	dummy	+
Farm size	Size of land under crop production (ha)	continuous	-
Ownership of livestock	Ownership of livestock (1/0)	dummy	+
Access to extension services	Access to extension services (1/0)	dummy	+

[a](+/-) indicates a positive or negative correlation with the dependent variable

Section 2: The demographic characterization of household heads in the study area

The descriptive analysis of the demographic characteristics of household heads in the study area is presented in Supplementary table 2.

The results show that there was an equal number of farms headed by men and women. Most of the farmers (43%) were between the ages of 52 and 66 years, whilst only 8% were youth (<35 years), thereby suggesting the low involvement of youth in agriculture in the study area. The results also indicate a low level of education in the study area with about 32% of farmers having no formal education whilst about 29% had completed secondary education. The main occupation for most of the farmers (78%) was either own or family farming, thereby suggesting a high reliance on farming activities for their livelihood.

The study revealed that most of the smallholder farmers (83%) were not generating any income from their farms, thereby suggesting that most of the farming activities were for subsistence purposes. Furthermore, the results indicate that most of the farmers (63%) had low off-farm income and were receiving ZAR1010–2000 (USD68.80–136.15) per month. These findings are in agreement with a previous study by Myeni et al.[7] in the study area that indicated that the majority of households relied on social grants such as old age and child support grants from the government as their major source of income.

The findings also indicate that the majority of the farmers had access to sources of media such as television (83%) and radio (76%) whilst only 3% owned computers. Most farmers did not own any means of transport with only about 8% having cars. The majority of the farmers (69%) were residing within a radius of 10–20 km from the market. The majority of the farmers (62%) owned 0.5–1 ha of land whilst about 29% owned less than 0.5 ha, thereby suggesting that most of the smallholder farmers owned very small plots of land. Only 24% of the smallholder farmers owned livestock, thereby suggesting that crop production was the main farming commodity in the study area, as also reported by Myeni et al.[7] Very few of the smallholder farmers (<2%) had access to institutions such as extension services, farmer associations and credit in the study area, as also reported by Myeni et al.[8,9]

Supplementary table 2: Descriptive analysis of the demographic characteristics of household heads (*n*=279

Household head	Description	Frequency (%)	Mean	SD	Min	Max
Gender	Male (1/0)	50.2	0.50	0.501	0	1
Age	20–35 (years)	7.9	31	3.847	21	35
	36–51 (years)	22.2	44	4.859	36	51
	52–66 (years)	43.0	61	4.311	52	66
	>67 (years)	26.9	74	6.764	67	95
Education	No formal education (years)	31.5	0.32	0.466	0	0
	Adult education (years)	1.8	0.02	0.133	1	8
	Primary education (years)	28.7	0.29	0.453	1	7
	Secondary education (years)	35.8	0.36	0.480	8	16
	Tertiary education (years)	2.2	0.02	0.145	15	20
Occupation	Own or family farming (1/0)	77.8	0.78	0.416	0	1
	Employed for farming (1/0)	7.1	0.07	0.258	0	1
	Self-employed (1/0)	3.6	0.04	0.186	0	1
	Employed in other sectors (1/0)	11.5	0.11	0.319	0	1
Monthly on-farm income	0 (ZAR)	83.2	0.00	0.000	0	0
	10–500 (ZAR)	12.1	289	136	100	500
	5010–2000 (ZAR)	2.9	1475	362	700	2000
	>2000 (ZAR)	1.8	3088	1093	2400	5000
Monthly off-farm income	<500 (ZAR)	8.2	121	170	0	380
	500–1000 (ZAR)	11.1	764	172	500	1000
	1010–2000 (ZAR)	62.7	1645	163	1140	2000
	2010–5000 (ZAR)	15.4	3389	699	2080	5000
	5010–10 000 (ZAR)	1.4	6500	1000	6000	8000
	>10 000 (ZAR)	1.1	13 000	2646	11 000	16 000
Media	Television (1/0)	82.8	0.84	0.397	0	1
	Radio (1/0)	76.0	0.73	0.434	0	1
	Computer (1/0)	2.5	0.03	0.157	0	1
Mode of transport owned	Car (1/0)	7.5	0.08	0.264	0	1
	Tractor (1/0)	0.7	0.01	0.085	0	1
	Truck/lorry (1/0)	0.4	0.00	0.060	0	1
	Bicycle (1/0)	1.1	0.01	0.103	0	1
Distance to market	<10 (km)	1.4	5.5	0.577	5	6
	10–20 (km)	68.5	15.87	3.043	10	20
	>20 (km)	30.1	26.71	2.274	25	30
Total area owned	<0.5 (ha)	29.4	0.30	0.112	0.10	0.49
	0.5–1 (ha)	62.0	0.81	0.234	0.5	1
	1.1–2.0 (ha)	5.4	1.56	0.349	1.2	2
	>2 (ha)	3.2	3.24	0.586	2.1	4
Ownership of livestock	Ownership of livestock (1/0)	24.0	0.24	0.428	0	1
Extension services	Access to extension services (1/0)	1.1	0.01	0.103	0	1
Credit	Access to credit (1/0)	1.8	0.02	0.133	0	1
Farmer associations	Access to farmer associations (1/0)	0.7	0.01	0.085	0	1

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