

Environment	Treatment Names	Plot size (m ²)	Maize Germination %	No. cobs harvested	Harvest kg/ha	Harvest T/ha
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH504	6.69	96.7	15	983.55	0.98
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	ZM607	7.32	100	21	412.56	0.41
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH505	6.99	100	22	804	0.8
TOTAL		21	296.7	58	2,200.11	2.19

Source: Primary data, October, 2020

The results of this research in Table 6 on maize harvest in Block 6 revealed that the recorded yields were 1,660.31 kg/ha on 6.3 m², 1,610.16 kg/ha on 7.08 m² and 3,044.44 kg/ha on 7.2 m², respectively. However, without chemical fertilizers by producing maize on the total area of 20.58m², 6314.93 kg/ha equivalent to 6.31 tons/ha were harvested in Block 6 (Table 4.6).

Table 6: Results of maize without chemical fertilizers in Block 6

Environment	Treatment Names	Plot size (m ²)	Maize Germination %	No. cobs harvested	Harvest kg/ha	Harvest T/ha
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH504	6.3	90	23	1,660.31	1.66
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	ZM607	7.08	100	30	1,610.16	1.61
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH505	7.2	93.3	30	3,044.44	3.04
TOTAL		20.58	283.3	83	6,314.91	6.31

Source: Primary data, October, 2020

The results of Block 7 in Table 7 on maize harvest indicated the registered yields were 3,797.22 kg/ha on 7.2 m², 4,562.84 kg/ha on 7.32m² and 4,250 kg/ha on 7.2 m², respectively. However, by applying chemical fertilizers at the dosage of 100-50 DAP/urea, by producing maize on the total area of 21.72m², 12,610.06 kg/ha equivalent to 12.61 tons/ha has been harvested in Block 7 (Table 7).

Table 7: Results of maize with only 100-50 kg DAP/urea in Block 7

Environment	Treatment Names	Plot size (m ²)	Maize		Harvest kg/ha	Harvest T/ha
			Germination %	No. cobs harvested		
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH504	7.2	83.3	37	3,797.22	3.8
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	ZM607	7.32	91.7	42	4,562.84	4.56
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH505	7.2	93.3	40	4250	4.25
TOTAL		21.72	268.3	119	12,610.06	12.61

Source: Primary data, May 2020

The results in Table 8 indicated that the results on maize harvest in Block 8 were namely 1,801.72 kg/ha on 6.96 m², 2,750 kg/ha on 7.2m² and 3,525.85 kg/ha on 7.272 m², respectively. This yield showed that the application of DAP and Urea at this dosage of 100-50 contributed significantly on maize productivity. However, by applying chemical fertilizers at the dosage of 100-50 DAP/urea on the total area of 21.162m², 8077.57 kg/ha equivalent to 8.08 tons/ha have been harvested in Block 8.

Table 8: Results of maize with only 100-50 kg DAP/urea in Block 8

Environment	Treatment Names	Plot size (m ²)	Maize		Harvest kg/ha	Harvest T/ha
			Germination %	No. cobs harvested		
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH504	6.69	94.4	46	1,801.72	1.8
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	ZM607	7.2	97.2	45	2,750.00	2.75
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH505	7.272	100	41	3,525.85	3.53
TOTAL		21.162	291.6	132	8,077.57	8.08

Source: Primary data, October, 2020

For Plot 9, the results in Table 9 on maize harvest indicated that the harvested maize yields were 2,254.41 kg/ha on 7.248 m², 4,201.36 kg/ha on 7.35m² and 2,952.77 kg/ha on 7.2 m², respectively. This yield showed that the application of DAP and Urea at this dosage of 100-50 contributed significantly on maize productivity. After applying chemical fertilizers at the dosage of 100-50 DAP/urea on the total area of 21.798m², 9,408.55 kg/ha equivalent to 9.4 tons/ ha

were harvested in Block 9. The last three tables (13.14 and 15) are showing the results of maize harvested for each variety (Table 9).

Table 9: Results of maize with only 100-50 kg DAP/urea in Block 9

Environment	Treatment Names	Plot size (m ²)	Maize Germination %	No. cobs harvested	Harvest kg/ha	Harvest T/ha
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH504	7.248	100	44	2,254.41	2.25
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	ZM607	7.35	94.4	40	4,201.36	4.2
Fert. 100 DAP-50 Urea at planting and 50 Urea at side dress	WH505	7.2	97.2	44	2,952.77	2.95
TOTAL		21.798	291.6	128	9,408.54	9.4

Source: Primary data, October, 2020

4.2 Maize variety's cumulative harvest

The results in Table 10 on the harvest of ZM 607 after using fertilizers showed the harvests of 3.43, 3.83 and 4.09 tones, respectively with a subtotal of 11.34 tones harvested on the area of 19.8978 m². The harvest without application of chemical fertilizers provided 1.39, 0.41 and 1.66 tones on the area of 20.76 m² with a subtotal of 3.46 tones harvested (Table 10). Furthermore, on the dosages of 100-50 kg DAP/urea, only 3.80, 1.80 and 2.95 with a subtotal of 8.55 tones harvested on the area of 21.36 m².

Table 101: Cumulative harvest of ZM 607 variety

Environment	Block	Plot size (m ²)	Maize Germination %	No. cobs harvested	Harvest kg/ha	Harvest T/ha
With fertilizers						
100-50 kg DAP / Urea and 50 kg Urea during weeding	1	6.8478	100		3,425.92	3.43
				34		
	2	6.9	100	36	3,831.88	3.83
	3	6.15	100	37	4,087.8	4.09
		19.8978		107	11,345.6	11.34
Sub-total 1					13,94.95	1.39
Without fertilizers						
	4		93.3	30		

		7.14				
	5	7.32	100	21	412.568	0.41
	6	6.3	90	23	1,660.32	1.66
Sub-total 2		20.76		74	3,467.84	3.46
100 DAP and 50 Urea only					3,797.22	3.8
	7	7.2		37		
			83.3			
	8	6.96	94.4	46	1,801.72	1.8
	9	7.2	97.2	44	2,952.78	2.95
Sub-total 3		21.36		127	8,551.72	8.55
TOTAL		62.0178		308	23,365.2	23.36

Source: Primary data, October, 2020

With regard to the maize variety WH 504, the results in Table 4.11 indicated the harvest of maize with application of chemical fertilizers on the dose of 100-50 kg DAP/urea during planting period and adding other 50 kg of urea during weeding. The findings in Table 4.11 showed the yields of 3.89, 3.17 and 2.02 tones, respectively as equivalent to 9.08 tones yielded on the area of 22.099 m² (Table 11). By only utilizing 100-50 kg DAP/ urea, the harvests of 4.56, 2.75 and 2.25 tones were harvested which sum up 9.56 tones on the area of 21.768 m² yielded (Table 11).

Table 11: Cumulative harvest of WH 504 variety

Environment	Block	Plot size (m ²)	Maize Germination %	No. cobs harvested	Harvest kg/ha	Harvest T/ha
With fertilizers						
100-50 kg DAP / Urea and 50 kg Urea during weeding	1	7.399	100		3,887.01	3.89
				39		
	2	7.35	100	32	3,167.35	3.17
	3	7.35	100	35	2,021.77	2.02
		22.099		106	9,076.13	9.08
Sub-total 1					6,16.667	0.62
Without fertilizers						
100 DAP and 50 Urea only	4	6	100	19		
	5	6.69	96.7	15	9,83.558	0.98
	6	7.08	100	30	1,610.17	1.61
		19.77		64	3,210.39	3.21
	Sub-total 2					45,62.84
100 DAP and 50 Urea only	7	7.32		42		
			91.7			
	8	7.2	97.2	45	2750	2.75
	9	7.248	100	44	2,254.42	2.25

Sub-total	21.768	131	9,567.26	9.56
TOTAL	70.777	301	21,853.8	21.85

Finally, for the WH 505 maize variety, the chemical fertilizers of 100-50 kg DAP/urea during plantation and adding 50kg of urea was added as detailed in Table 4.12. This application led to the harvests of 4.34; 4.81 and 4.21 tons, respectively equivalent to 13.36 tones yielded over 22.0176 m² (Table 12). The application of DAP/urea on the dose of 100-50 kg only contributed to 4.25, 2.25 and 4.20 tons, respectively and the total harvest was 10.70 tones on the area of 21.822 m² (Table 12). The results obtained without the use of chemical fertilizers were 1.53, 0.80 and 3.04 tons.

Table 12: Cumulative harvest of WH 505 variety

Environment	Block	Plot size (m ²)	Maize Germination %	No. cobs harvested	Harvest kg/ha	Harvest T/ha
With fertilizers						
					4342.935	4.34
100-50 kg DAP / Urea and 50 kg Urea during weeding		7.29	100	29		
	2	7.2	100	32	4813.888	4.81
	3	7.5276	100	40	4211.169	4.21
		22.0176		101	13367.992	13.36
					1531.68	1.53
Without fertilizers						
	4	7.26	100	27		
	5	6.99	100	22	804.0057	0.8
	6	7.2	93.3	30	3044.444	3.04
		21.45		79	5380.1297	5.38
Sub-total 2					4250	4.25
	7	7.2		40		
Fert 100 DAP and 50Urea only			91.7			
	8	7.272	100	44	2254.415	2.25
	9	7.35	94.4	40	4201.36	4.2
Sub-total 3		21.822		124	10705.775	10.7
TOTAL		72.4296		304	29453.897	29.45

Source: Primary data, October, 2020

5. Conclusion

The current study was conducted to analyze the contribution of applying chemical fertilizers on maize productivity in Karongi district, western Rwanda. Field observation was undertaken to test the result on maize productivity on plots with and that without chemical fertilizers. The results

showed that chemical fertilizers could increase maize productivity comparatively to produce without them. It is noted that after within plots in which chemical fertilizers were applied, 33.79 tons per 64.95.35 m² and 30.19 tons per 64.0144m² were respectively harvested. In plots without application of chemical fertilizers, 12.04 tons per 61.98 m² were harvested. Thus, a difference of 21.75tons and 18.15 tons from plot with chemical fertilizers to plots without chemical fertilizers, respectively. It is concluded that the application of chemical fertilizers contributed to increasing maize productivity but is still limited in scope. Although the expansion of this technique may require high cost that can necessitate government effort in increasing farmers 'capacity, if adopted more significant contribution on increasing maize productivity can be expected.

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