

APPENDIX I

PROFILE DESCRIPTIONS AND ANALYTICAL DATA

1.1	POTCHEFSTROOM:	RUTTON / VENTERSDORP 1.1.1 Profile description 1.1.2 Analytical data
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APPENDICES

Appendix 1.1.1 Soil Profile Potchefstroom **APPENDIX 1**

PROFILE DESCRIPTIONS AND ANALYTICAL DATA

Profile No.	Soil Form	Location
P319	Soil Form	Location
2626 West Rand	Soil Family	Ventersdorp
1.1 POTCHEFSTROOM:	HUTTON / VENTERSDORP	
1.1.1 Profile description		
1.1.2 Analytical data		
1.2 OTTOSDAL:	CLOVELLY/ MOOILAAGTE	
1.2.1 Profile description		
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1.3 SETLAGOLE:	CLOVELLY/ SETLAGOLE	
1.3.1 Profile description		
1.3.2 Analytical data		

Appendix 1.1.1 Soil Profile Description For Potchefstroom

General

Profile No	: P219	Soil Form	: Hutton
Map	: 2626 Wes-Rand	Soil Family	: Ventersdorp
Latitude & Longitude	: 26°44'36"/ 27°10'12"	Surface rock	: None
Land type No.	: Bc 25	Surface stoniness	: None
Climate zone	: 31S	Occurrence of flooding	: None
Altitude	: 1364m	Wind erosion	: Slight wind
Terrain unit	: Foot slope	Water erosion	: None
Slope	: 3%	Vegetation	: Grassveld
Slope shape	: Straight	Water table	: None
Aspect	: West	Described by	: R.W. Bruce
Micro-relief	: None	Date described	: 1977-03
Parent and underlying material	: Single, Local colluvium derived from Daspoort quartzite.	Weathering of underlying material	:

Horizon	Depth (mm)	Description	Diagnostic horizons
A1	: 0-350	Moist; moist 100% dark reddish brown 2.5 YR3/4; medium sandy loam; massive; slightly firm; very few medium soft insect casts; gradual smooth boundary.	Orthic
B21	: 350-760	Moist; moist 100% dark reddish brown 2.5YR3/4; medium sandy clay loam; apedal; slightly firm; diffuse smooth boundary.	Red apedal
B22	: 760-1200	Moist; moist 100% dark red 10YR3/6; medium sandy clay loam; apedal; slightly firm.	Red apedal

1.1.2 Soil Analytical Data for Potchefstroom

	Horizon name and depth (mm)		
	A1(0-350mm)	B1(350-760)	B2 (760-1200)
Particle size distribution (%)			
>2mm	0.0	0.0	1.00
C sand	5.00	7.00	7.00
M sand	33.0	36.0	30.0
F sand	40.0	33.0	36.0
C silt	8.0	4.0	4.0
Clay	12.0	21.0	25.0
Texture	SaLm	SaClLm	SaClLm
Chemical analysis			
C (%)	0.5	0.3	0.2
Resistance (ohm)	2800	2600	3000
pH H ₂ O	5.7	5.8	6.4
pH CaCl ₂	4.9	5.2	5.7
Exchangeable/ Extractable cation/ cmol (+) kg⁻¹ soil			
Na	0.10	0.00	0.10
K	0.20	0.10	0.00
Ca	1.60	2.00	1.90
Mg	0.60	0.90	0.80
S value	2.70	3.00	2.80
Cation exchange capacity (CEC)	4.50	5.07	4.30

Appendix 1.2.1 Soil Profile Description For Ottosdal

General			
Profile No	: P205	Soil Form	: Clovelly
Map	: 2624BB Wes-Rand	Soil Family	: Mooilaagte
Latitude & Longitude	: 26°50'24"/ 26°33'48"	Surface rock	: None
Land type No.	: Bc 23	Surface stoniness	: None
Climate zone	: 31S	Occurrence of flooding	: None
Altitude	: 1341m	Erosion	: Sheet, class 1
Terrain unit	: Foot slope	Vegetation/ Land use	: Agronomic cash crop
Slope	: 1%	Water table	: None
Slope shape	: Straight	Described by	: R.W. Bruce
Aspect	: East	Date described	: 1977-03
Micro-relief	: None	Weathering of	: underlying material
Parent and underlying material	: Single, Local colluvium overlying Ventersdorp lava.		

Horizon	Depth (mm)	Description	Diagnostic horizons
A1	: 0-260	Moist; moist 100% dark brown 7.5YR3/2; course sandy loam; massive; slightly firm; very few medium indurated iron-manganese nodules; very few small quartz fragments; gradual smooth boundary.	Orthic
B2	: 260-600	Moist; moist 100% brown to dark brown 7.5YR4/4; medium sandy clay loam; apedal; slightly firm; few medium indurated iron-manganese nodules; few small quartz and ferricrete fragments; abrupt smooth boundary.	Yellow-brown apedal
IIC	: 600-700	Many medium indurated iron-manganese nodules with common small quartz, lava and ferricrete fragments	

1.2.2 Soil Analytical Data for Ottosdal

	Horizon name and depth (mm)	
	A1 (0-260mm)	B2 (260-600)
Particle size distribution (%)		
>2mm	1.0	14.0
C sand	19.0	12.0
M sand	21.0	15.0
F sand	38.0	39.0
Silt	5.0	5.0
Clay	14	25.0
Texture	SaLm	SaClLm
Chemical analysis		
C (%)	0.5	0.4
Resistance (ohm)	3000	2700
pH H ₂ O	5.9	6.2
pH CaCl ₂	5.2	5.4
Exchangeable/ Extractable cation/ cmol (+) kg ⁻¹ soil		
Na	0.00	0.10
K	0.20	0.00
Ca	2.40	3.70
Mg	1.30	1.90
S value	3.90	5.70
Cation exchange capacity (CEC)	5.70	6.50

Appendix 1.3.1 Soil Profile Description For Setlagole

General			
Profile No	:	Soil Form	: Clovelly
Map	: 2624BBMosita	Soil Family	: Setlagole
Latitude & Longitude	: 26°18'22"/ 24°57'49"	Surface rock	: None
Land type No.	: Ah17	Surface stoniness	: None
Climate zone	: 8S	Occurrence of flooding	: None
Altitude	: 1270m	Wind erosion	: Slight wind
Terrain unit	: Foot slope	Water erosion	: None
Slope	: 1%	Vegetation/ Land use	: Agronomic cash crop
Slope shape	: Straight	Water table	: None
Aspect	: North-west	Described by	: C.J.J. Schmidt
Micro-relief	: None	Date described	: 1991-12
Parent material	: Single, Aeolian	Weathering of	:
		underlying material	
Underlying material	: Aeolian sand	Alteration of underlying material	: Generalized

Horizon	Depth (mm)	Description	Diagnostic horizons
A1	: 0-460	Moist; dry, brownish yellow 10YR6/8; moist, yellowish brown 10YR5/6; disturbed; loamy fine sand; apedal massive; friable; few normal fine pores; water absorption: 1 second; few roots; gradual smooth transition.	Orthic
B1	: 460-800	Moist; dry, brownish yellow 10YR6/8; moist, brownish yellow 10YR 6/6; undisturbed; loamy fine sand; apedal massive; friable; few normal fine pores; water absorption: 1 second; few roots; gradual smooth transition.	Yellow-brown apedal
B2	: 800-2000	Moist; dry, yellow 10YR7/8; moist, brownish yellow 10YR 6/8; undisturbed; loamy fine sand; apedal massive; friable; few normal fine pores; water absorption: 1 second; few roots	Yellow-brown apedal

1.3.2 Soil Analytical Data for Setlagole

	Horizon name and depth (mm)		
	Ap (0-460mm)	B1 (460-800)	B2 (800-2000)
<u>Particle size distribution (%)</u>			
>2mm	0.0	0.0	0.0
C sand 2-0.5 mm	6.7	6.5	4.8
M sand 0-0.25 mm	11.9	11.5	8.0
F sand 0.25-0.106 mm	51.9	46.2	46.5
Vf sand 0.106-0.05 mm	18.6	22.0	24.5
C silt 0.05-0.02 mm	3.0	3.4	4.3
F silt 0.02-0.002mm	1.0	1.5	1.2
Clay <0.002mm	6.3	8.7	10.4
Texture	FiSa	LmFiSa	LmFiSa
Chemical analysis			
C (%)	0.20	-	-
Resistance (ohm)	4200	4400	4000
pH H ₂ O	6.84	6.10	6.50
pH KCl	5.58	4.68	5.06
Exchangeable/ Extractable cation/ cmol (+) kg ⁻¹ soil			
Na	0.01	0.02	0.02
K	0.19	0.18	0.18
Ca	1.17	1.09	0.92
Mg	0.40	0.37	0.63
S value	1.77	1.66	1.75
T value (CEC)	1.90	2.11	2.02

APPENDIX 2

CYSLAMB SIMULATION REPORTS

CYSLAMB Report 1

2.1 POTCHEFSTROOM

2.2 OTTOSDAL

2.3 SETLAGOLE

Parameter	Value	Soil unit	Notes
Soil texture	Grey	Soil textural class	Medium
Target soil density	1400 (t/m ³)	Soil drainage class	Well
Management system	Strip	Soil depth for water	1.20 (m)
Plant population	0.2 / m ²	Water holding capacity	154 (mm)
Plant growing form	SEP1 to SEP3	Residual water at SEP1	40 (mm)
Plant root depth	0.60 (m)	Topsoil (0-100 mm)	100 (mm)
Plant type/height		Subsoil (100-200 mm)	100 (mm)
Plant growth form	OC1 to OC7	Subsoil (200-300 mm)	100 (mm)
Plant root depth	1.00 (m)	Subsoil (300-400 mm)	100 (mm)
Plant root diameter	10 (mm)	Weighted average (0-200 mm)	100 (mm)
Plant root length	30 (days)	Weighted average (200-400 mm)	100 (mm)
Plant root density	0 (per day)	Weighted average (400-600 mm)	100 (mm)
Plant root frequency	0 (break)	Weighted average (600-800 mm)	100 (mm)
Plant root order	0 (break)	Weighted average (800-1000 mm)	100 (mm)
Plant root class	0 (break)	Weighted average (1000-1200 mm)	100 (mm)
Plant root class	0 (break)	Weighted average (1200-1400 mm)	100 (mm)
Plant root class	0 (break)	Weighted average (1400-1600 mm)	100 (mm)
Plant root class	0 (break)	Weighted average (1600-1800 mm)	100 (mm)
Plant root class	0 (break)	Weighted average (1800-2000 mm)	100 (mm)

SOIL NUTRIENT BALANCE 1986/1987

2.1.1 POTCHEFSTROOM REPORT 1

CYSLAMB Report 1

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety : PAN473	Soil unit	: Hutton 20% Clay
Produce	: Grain	Soil textural class	: Medium
Target plant density	: 18000 (/ha)	Soil drainage class	: Well
Management system	: Sample2	Soil depth for Maize	: 1.20 (m)
Weed infestation	: 0% of max.	Water holding capacity	: 154 (mm/m)
Early ploughing from	: SEP1 to SEP3	Residual water at SEP1	: -9 (mm)
When topsoil storage	: 0 (mm)	Topsoil control depth	: 0.50 (m)
Planting opportunities	:	1 Available N (Undef.)	: -9 (ppm)
Planting occurs from	: OCT2 to OCT2	Available P (Bray-I)	: 40 (ppm)
when topsoil storage	: 10 (mm)	Available K (Undef.)	: -9 (ppm)
and dekad rainfall	: 10 (mm)	Weighted average pH-H ₂ O	: 7.0 (pH)
Weeding occurs after	: 30 days	Weighted average EC _e	: -9.0 (mS/cm)
Irrigation capacity	: 0 (mm/day)	Weighted average ESP	: -9 (%)
Irrigation frequency	: 0.00(/dekad)	Weeds maximum evapotr.	: %-9.00 x ET ₀
Synoptic station	: C19869	Weeds max. cover after	: -9 days
Rainfall station	: C19869	Range of rainfall years	: 1986/1986

(-9 = unknown / missing value)

SOIL MOISTURE BALANCE 1986/1987

DEK	ST.D (cm)	δST (mm)	RAIN (mm)	IRRI (mm)	MOIS (mm)	Eb (mm)	ETw (mm)	ETa (mm)	ST (mm)	MBRZ (mm)	Surpl (mm)	W.FR (cm)	ETm (mm)	STRESS (%)
³SEP1	50								0	0		0		
³SEP2	50		0		0	0			0	0	0	0		
³SEP3	50		14		14	14			0	0	0	0		
³OCT1	50		0		0	0			0	0	0	0		
ÝÄÄ>	0	0		0	0				0	0		0		
ÝOCT2	22	0	11	0	11			11	0	0	0	7	28	61
ÝOCT3	39	0	27	0	27			23	4	0	0	18	28	18
ÝNOV1	57	0	60	0	64			32	32	0	0	42	32	0
ÝNOV2	75	0	10	0	42			28	14	0	0	42	39	28
ÝNOV3	93	0	15	0	29			17	12	0	0	42	46	63
ÝDEC1	111	0	104	0	116			53	63	0	0	77	53	0
ÝDEC2	120	0	18	0	81			43	38	0	0	77	62	31
ÝDEC3	120	0	53	0	91			49	42	0	0	77	68	28
ÝJAN1	120	0	9	0	51			27	24	0	0	77	64	58
ÝJAN2	120	0	80	0	104			53	51	0	0	77	62	15
ÝJAN3	120	0	22	0	73			38	35	0	0	77	56	32
ÝFEB1	120	0	0	0	35			18	17	0	0	77	57	68
ÝFEB2	120	0	16	0	33			17	16	0	0	77	57	70
ÝFEB3	120	0	46	0	62			32	30	0	0	77	56	43

DEK: dekad, ST.D: storage/rooting depth, δST: storage increase due to δST.D,
 RAIN: rainfall, IRRI: irrigation, MOIS: avail. moisture, Eb: bare soil evap.,
 ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
 MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
 ETm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at OCT2 of 1986)

Period (days after planting)	26-45	46-70	71-90	71-125	91-125	126-145
Crop biomass reduction	10%	14%	32%	-	29%	19%

Total Crop biomass reduction, multiplied for the 5 individual periods = 70%
 Total Crop biomass reduction for the whole growing period (day 1-145) = 55%

OVERALL RESULTS 1986 - 1987

CROP BIOMASS REDUCTION, DUE TO THE SOIL - nutrient status : 0% (NUTRI)
 - salinity (ECe) : 0% (SALIN)
 - sodicity (ESP) : 0% (SODIC)
 - alkalinity (pH) : 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP (kg/ha)	IRRI (mm)	M.p (%)	M.t (%)	SURP (%)	NBP.p (kg/ha)	HI.p (%)	YLD.p (kg/ha)	NBP.t (kg/ha)	HI.t (%)	YLD.t (kg/ha)
1986	Oct2,	13900	0	70	55	0	4170	49	2320	6260	49	3460

YR & DEK: date of planting; P.NBP: potential net biomass production; IRRI:
 irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for
 all individual crop development periods (M.p), or estimated over the total
 crop growing period (M.t); SURP: biomass reduction due to moisture surplus;
 NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP,
 NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t:
 yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

2.1.2 POTCHEFSTROOM REPORT 2

CYSLAMB Report 2

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety : PAN473	Soil unit	: Hutton 20% Clay
Produce	: Grain	Soil textural class	: Medium
Target plant density	: 18000 (/ha)	Soil drainage class	: Well
Management system	: Sample2	Soil depth for Maize	: 1.20 (m)
Weed infestation	: 0% of max.	Water holding capacity	: 154 (mm/m)
Early ploughing from	: SEP1 to SEP3	Residual water at SEP1	: -9 (mm)
when topsoil storage	: 0 (mm)	Topsoil control depth	: 0.50 (m)
Planting opportunities	:	1 Available N (Undef.)	: -9 (ppm)
Planting occurs from	: Nov1 to Nov1	Available P (Bray-I)	: 40 (ppm)
when topsoil storage	: 10 (mm)	Available K (Undef.)	: -9 (ppm)
and dekad rainfall	: 10 (mm)	Weighted average pH-H2O	: 7.0 (pH)
Weeding occurs after	: 30 days	Weighted average ECe	: -9.0 (mS/cm)
Irrigation capacity	: 0 (mm/day)	Weighted average ESP	: -9 (%)
Irrigation frequency	: 0.00(/dekad)	Weeds maximum evapotr.	: %-9.00 x ET0
Synoptic station	: C19869	Weeds max. cover after	: -9 days
Rainfall station	: C19869	Range of rainfall years	: 1986/1986

(-9 = unknown / missing value)

SOIL MOISTURE BALANCE 1986/1987

^o DEK	ST.D	δST	RAIN	IRRI	MOIS	Eb	ETw	ETa	ST	MBRZ	Surpl	W.FR	ETm	STRESS
^a	(cm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(cm)	(mm)	(%)
^o SEP1	50								0	0		0		
^o SEP2	50		0		0	0			0	0	0	0		
^o SEP3	50		14		14	14			0	0	0	0		
^o OCT1	50		0		0	0			0	0	0	0		
^o OCT2	50		11		11	11			0	0	0	0		
^o OCT3	50		27		27	27			0	0	0	0		
ÝÄÄ>	0	0		0	0				0	0		0		
ÝNOV1	22	0	60	0	52			37	14	8	0	27	37	0
ÝNOV2	39	8	10	0	32			27	5	0	0	27	37	27
ÝNOV3	57	0	15	0	20			16	4	0	0	27	37	57
ÝDEC1	75	0	104	0	108			42	66	0	0	72	42	0
ÝDEC2	93	0	18	0	84			46	38	0	0	72	49	6
ÝDEC3	111	0	53	0	91			49	42	0	0	72	58	16
ÝJAN1	120	0	9	0	51			27	24	0	0	72	61	56
ÝJAN2	120	0	80	0	104			53	51	0	0	72	62	15
ÝJAN3	120	0	22	0	73			38	35	0	0	72	56	32
ÝFEB1	120	0	0	0	35			18	17	0	0	72	57	68
ÝFEB2	120	0	16	0	33			17	16	0	0	72	58	71
ÝFEB3	120	0	46	0	62			32	30	0	0	72	58	45
ÝMAR1	120	0	14	0	44			22	22	0	0	72	51	57
ÝMAR2	120	0	8	0	30			15	15	0	0	72	47	68

DEK: dekad, ST.D: storage/rooting depth, δST: storage increase due to δST.D,
RAIN: rainfall, IRRI: irrigation, MOIS: avail. moisture, Eb: bare soil evap.,
ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
ETm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at NOV1 of 1986)

Period (days after planting)	26- 45	46- 70	71Ä-90	71-125	91-125	126-145
Crop biomass reduction	4%	9%	-	45%	-	13%

Total Crop biomass reduction, multiplied for the 4 individual periods = **58%**
Total Crop biomass reduction for the whole growing period (day 1Ä145) = **56%**

OVERALL RESULTS 1986 – 1987

CROP BIOMASS REDUCTION, DUE TO THE SOIL - nutrient status : 0% (NUTRI)

- salinity (ECe) : 0% (SALIN)
- sodicity (ESP) : 0% (SODIC)
- alkalinity (pH) : 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP	IRRI	M.p	M.t	SURP	NBP.p	HI.p	YLD.p	NBP.t	HI.t	YLD.t
		(kg/ha)	(mm)	(%)	(%)	(%)	(kg/ha)	(%)	(kg/ha)	(kg/ha)	(%)	(kg/ha)
1986	Nov1,	13720	0	58	56	0	5760	49	3210	6040	49	3340

YR & DEK: date of planting; P.NBP: potential net biomass production; IRRI: irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for all individual crop development periods (M.p), or estimated over the total crop growing period (M.t); SURP: biomass reduction due to moisture surplus; NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP, NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t: yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

2.1.3 POTCHEFSTROOM REPORT 3

CYSLAMB Report3

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety	: PAN473	Soil unit	:	Hutton 20%Clay
Produce		: Grain	Soil textural class	:	Medium
Target plant density		: 18000 (/ha)	Soil drainage class	:	Well
Management system		: Sample2c	Soil depth for Maize:		1.20 (m)
Weed infestation		: 0% of max.	Water holding capacity:		154 (mm/m)
Early ploughing from		: SEP1 to SEP3	Residual water at SEP1:		-9 (mm)
When topsoil storage		: 0 (mm)	Topsoil control depth:		0.50 (m)
Planting opportunities		:	1 Available N (Undef.):		-9 (ppm)
Planting occurs from		: NOV3 to NOV3	Available P (Bray-I):		40 (ppm)
When topsoil storage		: 10 (mm)	Available K (Undef.):		-9 (ppm)
And dekad rainfall		: 10 (mm)	Weighted average pH-H2O:		7.0 (pH)
Weeding occurs after		: 30 days	Weighted average ECe:		-9.0 (mS/cm)
Irrigation capacity		: 0 (mm/day)	Weighted average ESP:		-9 (%)
Irrigation frequency		: 0.00(/dekad)	Weeds maximum evapotr. :		%-9.00 x ET0
Synoptic station		: C19869	Weeds max. Cover after:		-9 days
Rainfall station		: C19869	Range of rainfall years:		1986/1986

(-9 = unknown / missing value)

SOIL MOISTURE BALANCE 1986/1987

³ DEK	ST.D	δST	RAIN	IRRI	MOIS	Eb	ETw	ETa	ST	MBRZ	Surpl	W.FR	ETm	STRESS
³	(cm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(cm)	(mm)	(%)
³ SEP1	50								0	0	0	0		
³ SEP2	50		0		0	0			0	0	0	0		
³ SEP3	50		14		14	14			0	0	0	0		
³ OCT1	50		0		0	0			0	0	0	0		
³ OCT2	50		11		11	11			0	0	0	0		
³ OCT3	50		27		27	27			0	0	0	0		
³ NOV1	50		60		60	37			23	0	0	40		
³ NOV2	50		10		33	33			0	0	0	0		
Y ÅÅ>	0	0		0	0				0	0	0	0		
YNOV3	22	0	15	0	15			15	0	0	0	10	38	61
YDEC1	39	0	104	0	78			37	40	26	0	57	37	0
YDEC2	57	26	18	0	84			38	46	0	0	57	38	0
YDEC3	75	0	53	0	99			45	54	0	0	66	45	0
YJAN1	93	0	9	0	63			37	26	0	0	66	49	24
YJAN2	111	0	80	0	106			52	54	0	0	70	54	4
YJAN3	120	0	22	0	76			39	37	0	0	70	53	26
YFEB1	120	0	0	0	37			19	18	0	0	70	57	67
YFEB2	120	0	16	0	34			18	16	0	0	70	58	69
YFEB3	120	0	46	0	62			32	30	0	0	70	58	45
YMAR1	120	0	14	0	44			22	22	0	0	70	51	57
YMAR2	120	0	8	0	30			15	15	0	0	70	49	69
YMAR3	120	0	0	0	15			8	7	0	0	70	43	81
YAPR1	120	0	0	0	7			4	3	0	0	70	44	91

DEK: dekad, ST.D: storage/rooting depth, δST: storage increase due to δST.D,
 RAIN: rainfall, IRRI: irrigation, MOIS: avail. Moisture, Eb: bare soil evap.,
 ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
 MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
 ETm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at NOV3 of 1986)

Period (days after planting)	26-40	41-55	56-90	56-135	91-135	136-140
Crop biomass reduction	4%	8%		65%		16%

Total Crop biomass reduction, multiplied for the 4 individual periods = 74%
 Total Crop biomass reduction for the whole growing period (day 1-145) = 61%

OVERALL RESULTS 1986 - 1987

CROP BIOMASS REDUCTION, DUE TO THE SOIL - nutrient status : 0% (NUTRI)

- Salinity (ECe) : 0% (SALIN)
- Sodidity (ESP) : 0% (SODIC)
- Alkalinity (pH) : 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP	IRRI	M.p	M.t	SURP	NBP.p	HI.p	YLD.p	NBP.t	HI.t	YLD.t
		(kg/ha)	(mm)	(%)	(%)	(%)	(kg/ha)	(%)	(kg/ha)	(kg/ha)	(%)	(kg/ha)
1986	Nov3,	13156	0	74	61	0	3420	49	1900	5130	49	2860

YR & DEK: date of planting; P.NBP: potential net biomass production; IRRI: Irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for all individual crop development periods (M.p), or estimated over the total crop growing period (M.t); SURP: biomass reduction due to moisture surplus; NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP, NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t: yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

2.2.1 OTTOSDAL REPORT 1

CYSLAMB Report 4

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety	: PAN473	Soil unit	: Cv 15% Clay
Produce		: Grain	Soil textural class	: Medium
Target plant density		: 15000 (/ha)	Soil drainage class	: Well
Management system		: Sample2c	Soil depth for Maize	: 1.80 (m)
Weed infestation		: 0% of max.	Water holding capacity	: 152 (mm/m)
Early ploughing from		: SEP1 to SEP3	Residual water at SEP1	: -9 (mm)
When topsoil storage		: 0 (mm)	Topsoil control depth	: 0.50 (m)
Planting opportunities		: 1 Available N (Undef.)		: -9 (ppm)
Planting occurs from		: DEC2 to DEC2	Available P (Bray-I)	: 10 (ppm)
When topsoil storage		: 10 (mm)	Available K (Undef.)	: -9 (ppm)
And dekad rainfall		: 10 (mm)	Weighted average pH-H2O	: 7.0 (pH)
Weeding occurs after		: 30 days	Weighted average Ece	: -9.0 (mS/cm)
Irrigation capacity		: 0 (mm/day)	Weighted average ESP	: -9 (%)
Irrigation frequency		: 0.00(/dekad)	Weeds maximum evapotr.	: %-9.00 x ETO
Synoptic station		: C19891	Weeds max. cover after	: -9 days
Rainfall station		: OT9004	Range of rainfall years	: 1990/1990

(-9 = unknown / missing value)

SOIL MOISTURE BALANCE 1990/1991

³ DEK	ST.D	δST	RAIN	IRRI	MOIS	Eb	ETw	Eta	ST	MBRZ	Surpl	W.FR	ETm	STRESS
	(cm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(cm)	(mm)	(%)
³ SEP1	50								0	0		0		
³ SEP2	50		0		0	0			0	0	0	0		
³ SEP3	50		0		0	0			0	0	0	0		
³ OCT1	50		0		0	0			0	0	0	0		
³ OCT2	50		0		0	0			0	0	0	0		
³ OCT3	50		0		0	0			0	0	0	0		
³ NOV1	50		0		0	0			0	0	0	0		
³ NOV2	50		0		0	0			0	0	0	0		
³ NOV3	50		0		0	0			0	0	0	0		
³ DEC1	50		70		70	52			18	0	0	46		
YAA>	0	-18		0	0				0	18		46		
YDEC2	19	7	0	0	7			7	0	11	0	46	46	85
YDEC3	39	8	0	0	8			7	1	3	0	46	49	86
YJAN1	58	3	53	0	57			39	18	0	0	46	49	20
YJAN2	77	0	22	0	40			23	17	0	0	46	45	49
YJAN3	97	0	90	0	107			43	64	0	0	70	43	0
YFEB1	116	0	52	0	116			43	73	0	0	76	43	0
YFEB2	135	0	40	0	113			34	79	0	0	76	34	0
YFEB3	154	0	0	0	79			27	52	0	0	76	39	31
YMAR1	174	0	19	0	71			21	50	0	0	76	32	34
YMAR2	180	0	123	0	173			35	138	0	0	114	35	0
YMAR3	180	0	0	0	138			33	105	0	0	114	33	0
YAPR1	180	0	0	0	105			28	77	0	0	114	28	0
YAPR2	180	0	0	0	77			21	56	0	0	114	26	19
YAPR3	180	0	0	0	56			15	41	0	0	114	23	35

DEK: dekad, ST.D: storage/rooting depth, δST: storage increase due to δST.D,
 RAIN: rainfall, IRRI: irrigation, MOIS: avail. moisture, Eb: bare soil evap.,
 ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
 MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
 ETm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at DEC2 of 1990)

Period (days after planting)	26- 45	46- 70	71- 90	71-125	91-125	126-145
Crop biomass reduction	10%	0%	20%		1%	9%

Total Crop biomass reduction, multiplied for the 5 individual periods = 36%
 Total Crop biomass reduction for the whole growing period (day 1A145) = 35%

OVERALL RESULTS 1990 - 1991

CROP BIOMASS REDUCTION, DUE TO THE SOIL - available P: 5% (NUTRI)

- Salinity (ECe): 0% (SALIN)
- Sodcity (ESP): 0% (SODIC)
- Alkalinity (pH): 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP	IRRI	M.p	M.t	SURP	NBP.p	HI.p	YLD.p	NBP.t	HI.t	YLD.t
		(kg/ha)	(mm)	(%)	(%)	(%)	(kg/ha)	(%)	(kg/ha)	(kg/ha)	(%)	(kg/ha)
1990	Dec2,	12700	0	36	35	0	7720	50	4390	7840	50	4450

YR & DEK: date of planting; P.NBP: potential net biomass production; IRRI: Irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for all individual crop development periods (M.p), or estimated over the total crop growing period (M.t); SURP: biomass reduction due to moisture surplus; NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP, NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t: yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

2.2.2 OTTOSDAL REPORT 2

CYSLAMB Report 5

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety	: PAN473	Soil unit	: Cv 15% Clay
Produce		: Grain	Soil textural class	: Medium
Target plant density		: 16000 (/ha)	Soil drainage class	: Well
Management system		: Sample2c	Soil depth for Maize	: 1.80 (m)
Weed infestation		: 0% of max.	Water holding capacity	: 152 (mm/m)
Early ploughing from		: SEP1 to SEP3	Residual water at SEP1	: -9 (mm)
When topsoil storage		: 0 (mm)	Topsoil control depth	: 0.50 (m)
Planting opportunities		: 1 Available N (Undef.)		: -9 (ppm)
Planting occurs from		: DEC1 to DEC1	Available P (Bray-I)	: 10 (ppm)
When topsoil storage		: 10 (mm)	Available K (Undef.)	: -9 (ppm)
and dekad rainfall		: 10 (mm)	Weighted average pH-H2O	: 7.0 (pH)
Weeding occurs after		: 30 days	Weighted average ECe	: -9.0 (mS/cm)
Irrigation capacity		: 0 (mm/day)	Weighted average ESP	: -9 (%)
Irrigation frequency		: 0.00(/dekad)	Weeds maximum evapotr.	: %-9.00 x ET0
Synoptic station		: C19891	Weeds max. cover after	: -9 days
Rainfall station		: C19891	Range of rainfall years	: 1991/1991

(-9 = unknown / missing value)

SOIL MOISTURE BALANCE 1991/1992

DEK	ST.D	δST	RAIN	IRRI	MOIS	Eb	ETw	ETa	ST	MBRZ	Surpl	W.FR	ETm	STRESS
	(cm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(cm)	(mm)	(%)
³AUG3	50								0	0		0		
³SEP1	50		0		0	0			0	0	0	0		
³SEP2	50		0		0	0			0	0	0	0		
³SEP3	50		45		45	15			30	0	0	30		
³OCT1	50		0		30	16			14	0	0	30		
³OCT2	50		9		23	23			0	0	0	0		
³OCT3	50		25		25	25			0	0	0	0		
³NOV1	50		4		4	4			0	0	0	0		
³NOV2	50		2		2	2			0	0	0	0		
³NOV3	50		11		11	11			0	0	0	0		
ÝDEC1	19	0	18	0	18			18	0	0	0	12	52	65
ÝDEC2	39	0	15	0	15			13	2	0	0	12	51	75
ÝDEC3	58	0	42	0	44			31	13	0	0	29	54	43
ÝJAN1	77	0	0	0	13			8	5	0	0	29	53	85
ÝJAN2	97	0	13	0	18			9	9	0	0	29	46	80
ÝJAN3	116	0	24	0	33			14	19	0	0	29	42	67
ÝFEB1	135	0	15	0	34			13	21	0	0	29	41	68
ÝFEB2	154	0	16	0	37			12	25	0	0	29	31	61
ÝFEB3	174	0	5	0	30			9	21	0	0	29	36	75
ÝMAR1	180	0	0	0	21			6	15	0	0	29	30	80
ÝMAR2	180	0	14	0	29			8	21	0	0	29	32	75
ÝMAR3	180	0	2	0	23			6	17	0	0	29	30	80
ÝAPR1	180	0	30	0	47			13	34	0	0	31	25	48
ÝAPR2	180	0	7	0	41			11	30	0	0	31	21	48

DEK: dekad, ST.D: storage/rooting depth, δST: storage increase due to δST.D,
RAIN: rainfall, IRR1: irrigation, MOIS: avail. Moisture, Eb: bare soil evap.,
ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
Etm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at DEC1 of 1991)

Period (days after planting)	26--45	46-70	71- 90	71-125	91-125	126-145
Crop biomass reduction	11%	18%		72%		10%

Total Crop biomass reduction, multiplied for the 4 individual periods = 81%
Total Crop biomass reduction for the whole growing period (day 1-145) = 86%

OVERALL RESULTS 1991 - 1992

CROP BIOMASS REDUCTION, DUE TO THE SOIL - available P : 5% (NUTRI)

- salinity (ECe) : 0% (SALIN)
- sodicity (ESP) : 0% (SODIC)
- alkalinity (pH) : 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP	IRRI	M.p	M.t	SURP	NBP.p	HI.p	YLD.p	NBP.t	HI.t	YLD.t
		(kg/ha)	(mm)	(%)	(%)	(%)	(kg/ha)	(%)	(kg/ha)	(kg/ha)	(%)	(kg/ha)
1991	Dec1,	13070	0	81	86	0	2360	49	1310	1740	48	950

YR & DEK: date of planting; P.NBP: potential net biomass production; IRR1: irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for all individual crop development periods (M.p), or estimated over the total Crop growing period (M.t); SURP: biomass reduction due to moisture surplus; NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP, NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t: Yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

2.2.3 OTTOSDAL REPORT 3

CYSLAMB Report 6

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety	: PAN473	Soil unit	: Cvot15
Produce		: Grain	Soil textural class	: Medium
Target plant density		: 19000 (/ha)	Soil drainage class	: Well
Management system		: Sample2c	Soil depth for Maize	: 1.80 (m)
Weed infestation		: 0% of max.	Water holding capacity	: 152 (mm/m)
Early ploughing from		: SEP1 to SEP3	Residual water at SEP1	: -9 (mm)
when topsoil storage		: 0 (mm)	Topsoil control depth	: 0.50 (m)
Planting opportunities		: 1 Available N (Undef.)		: -9 (ppm)
Planting occurs from		: NOV3 to NOV3	Available P (Bray-I)	: 10 (ppm)
when topsoil storage		: 0 (mm)	Available K (Undef.)	: -9 (ppm)
and dekad rainfall		: 0 (mm)	Weighted average pH-H2O	: 7.0 (pH)
Weeding occurs after		: 30 days	Weighted average ECe	: -9.0 (mS/cm)
Irrigation capacity		: 0 (mm/day)	Weighted average ESP	: -9 (%)
Irrigation frequency		: 0.00(/dekad)	Weeds maximum evapotr.	: %-9.00 x ET0
Synoptic station		: C19891	Weeds max. cover after	: -9 days
Rainfall station		: C19891	Range of rainfall years	: 1992/1992

(-9 = unknown / missing value)

Total Crop Moisture Reduction, assumed for the whole growing period = 81%

Total Crop Moisture Reduction for the whole growing period by 1992 = 12%

OVERALL RESULTS 1992 - 1992

CROP MOISTURE REDUCTION DUE TO THE SOIL

Availability (Ca) 1% (0.00%)

Availability (SP) 0% (0.00%)

Availability (pH) 0% (0.00%)

CRUP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY

Yr	Plant	Plant	Plant	Plant	Plant	Plant	Plant	Plant	Plant	Plant	Plant	Plant	Plant	Plant
1992	INDY	INDY	INDY	INDY	INDY	INDY	INDY	INDY	INDY	INDY	INDY	INDY	INDY	INDY

Yr & Dek date of planting - P NDF possible net available production - 10%

Yr & Dek date of planting - P NDF possible net available production - 10%

All individual crop development variables (M, S, or S) shown over the year

Crop growing period (M) or (S) NDF increases reduction due to moisture surplus

NDF at net biomass production after correcting P NDF for total NDF

MULTI-MULTI (S) and (S) NDF, as per harvest index for NDF at 1.00 g

Yield harvested from NDF per production content of harvested biomass = 12%

SOIL MOISTURE BALANCE 1992/1993

DEK	ST.D	δST	RAIN	IRRI	MOIS	Eb	ETw	ETa	ST	MBRZ	Surpl	W.FR	ETm	STRESS
	(cm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(cm)	(mm)	(%)
³AUG3	50								0	0		0		
³SEP1	50		0		0	0			0	0	0	0		
³SEP2	50		0		0	0			0	0	0	0		
³SEP3	50		0		0	0			0	0	0	0		
³OCT1	50		10		10	10			0	0	0	0		
³OCT2	50		7		7	7			0	0	0	0		
³OCT3	50		0		0	0			0	0	0	0		
³NOV1	50		90		76	43			40	7	0	59		
³NOV2	50		29		69	35			35	6	0	59		
ÝNOV3	19	12	3	0	15			14	1	26	0	59	32	56
ÝDEC1	39	13	0	0	14			11	3	13	0	59	33	67
ÝDEC2	58	12	30	0	45			28	17	1	0	59	33	15
ÝDEC3	77	1	23	0	41			23	18	0	0	59	37	38
ÝJAN1	97	0	3	0	21			10	11	0	0	59	40	75
ÝJAN2	116	0	0	0	11			5	6	0	0	59	38	87
ÝJAN3	135	0	60	0	66			25	41	0	0	59	39	36
ÝFEB1	154	0	8	0	49			17	32	0	0	59	40	58
ÝFEB2	174	0	19	0	51			15	36	0	0	59	31	52
ÝFEB3	180	0	24	0	60			18	42	0	0	59	36	50
ÝMAR1	180	0	13	0	55			16	39	0	0	59	30	47
ÝMAR2	180	0	24	0	63			18	45	0	0	59	32	44
ÝMAR3	180	0	16	0	61			17	44	0	0	59	30	43
ÝAPR1	180	0	34	0	78			21	57	0	0	59	23	9

DEK: dekad, ST.D: storage/rooting depth, δST: storage increase due to δST.D,
 RAIN: rainfall, IRRI: irrigation, MOIS: avail. Moisture, Eb: bare soil evap.,
 ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
 MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
 ETm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at NOV3 of 1992)

Period (days after planting)	26- 45	46-70	71- 90	71-125	91-125	126-145
Crop biomass reduction	7%	16%	-	50%	-	5%

Total Crop biomass reduction, multiplied for the 4 individual periods = **63%**
 Total Crop biomass reduction for the whole growing period (day 1-145) = **62%**

OVERALL RESULTS 1992 – 1993

CROP BIOMASS REDUCTION, DUE TO THE SOIL - available P : 5% (NUTRI)
 - salinity (ECe) : 0% (SALIN)
 - sodicity (ESP) : 0% (SODIC)
 - alkalinity (pH) : 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP	IRRI	M.p	M.t	SURP	NBP.p	HI.p	YLD.p	NBP.t	HI.t	YLD.t
		(kg/ha)	(mm)	(%)	(%)	(%)	(kg/ha)	(%)	(kg/ha)	(kg/ha)	(%)	(kg/ha)
1992	NOV3 ^a	13780	0	63	62	0	4840	49	2700	4970	49	2770

YR & DEK: date of planting; P.NBP: potential net biomass production; IRRI: Irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for All individual crop development periods (M.p), or estimated over the total Crop growing period (M.t); SURP: biomass reduction due to moisture surplus; NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP, NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t: Yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

2.3.1 SETLAGOLE REPORT 1

CYSLAMB Report7

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety : PAN473	Soil unit	: Cv 10%C
Produce	: Grain	Soil textural class	: Medium
Target plant density	: 14000 (/ha)	Soil drainage class	: Well
Management system	: Sample2c	Soil depth for Maize	: 2.10 (m)
Weed infestation	: 0% of max.	Water holding capacity	: 148 (mm/m)
Early ploughing from	: SEP1 to SEP3	Residual water at JUL3	: -9 (mm)
When topsoil storage	: 0 (mm)	Topsoil control depth	: 0.50 (m)
Planting opportunities	: 1	Available N (Undef.)	: -9 (ppm)
Planting occurs from	: DEC1 to DEC1	Available P (Bray-I)	: 23 (ppm)
When topsoil storage	: 0 (mm)	Available K (Undef.)	: -9 (ppm)
And dekad rainfall	: 0 (mm)	Weighted average pH-H2O	: 6.6 (pH)
Weeding occurs after	: 30 days	Weighted average ECe	: -9.0 (mS/cm)
Irrigation capacity	: 0 (mm/day)	Weighted average ESP	: -9 (%)
Irrigation frequency	: 0.00(/dekad)	Weeds maximum evapotr. %	: -9.00 x ET
Synoptic station	: MADIBOGO	Weeds max. cover after	: -9 days
Rainfall station	: MADIBOGO	Range of rainfall years	: 1993/1993

(-9 = unknown / missing value)

SIMULATED SOIL MOISTURE BALANCE 1993/1994

DEK	ST.D	δST	RAIN	IRRI	MOIS	Eb	ETw	ETa	ST	MBRZ	Surpl	W.FR	Etm	STRESS
	(cm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(cm)	(mm)	(%)
³ JUL2	50							0	0			0		
³ JUL3	50		0		0	0		0	0	0		0		
³ AUG1	50		0		0	0		0	0	0		0		
³ AUG2	50		0		0	0		0	0	0		0		
³ AUG3	50		2		2	2		0	0	0		0		
³ SEP1	50		0		0	0		0	0	0		0		
³ SEP2	50		0		0	0		0	0	0		0		
³ SEP3	50		1		1	1		0	0	0		0		
³ OCT1	50		65		65	19		46	0	0		44		
³ OCT2	50		44		74	39		42	9	0		61		
³ OCT3	50		21		63	38		28	6	0		61		
³ NOV1	50		18		46	42		8	2	0		61		
³ NOV2	50		0		8	10		0	0	0		0		
³ NOV3	50		15		15	15		0	0	0		74		
YDEC1	19	9	1	0	10		10	0	26	0		74	43	77
YDEC2	39	9	11	0	20		16	4	17	0		74	44	64
YDEC3	58	9	89	0	102		47	55	8	0		74	47	0
YJAN1	77	8	14	0	77		43	34	0	0		74	48	10
YJAN2	97	0	114	0	148		43	105	0	0		85	43	0
YJAN3	116	0	16	0	121		39	82	0	0		85	39	0
YFEB1	135	0	22	0	104		37	67	0	0		85	38	3
YFEB2	154	0	25	0	92		32	60	0	0		85	38	16
YFEB3	174	0	2	0	62		19	43	0	0		85	38	50
YMAR1	193	0	20	0	63		18	45	0	0		85	35	49
YMAR2	210	0	4	0	49		13	36	0	0		85	33	61
YMAR3	210	0	4	0	40		10	30	0	0		85	29	66
YAPR1	210	0	0	0	30		7	23	0	0		85	27	74
YAPR2	210	0	11	0	34		8	26	0	0		85	24	67

DEK: dekad, ST.D: storage/rooting depth, δST: storage increase due to δST.D,
 RAIN: rainfall, IRRI: irrigation, MOIS: avail. Moisture, Eb: bare soil evap.,
 ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
 MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
 ETm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at DEC1 of 1993)

Period (days after planting)	26- 45	46- 70	71- 90	71- 125	91- 125	126- 145
Crop biomass reduction	1%	0%	-	49%	-	14%

Total Crop biomass reduction, multiplied for the 4 individual periods = **56%**
 Total Crop biomass reduction for the whole growing period (day 1-145) = **46%**

OVERALL RESULTS 1993 – 1994

CROP BIOMASS REDUCTION, DUE TO THE SOIL Nutrient status 0% (NUTRI)
 Salinity (ECe) 0% (SALIN)
 Sodidity (ESP) 0% (SODIC)
 Alkalinity (pH) 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP	IRRI	M.p	M.t	SURP	NBP.p	HI.p	YLD.p	NBP.t	HI.t	YLD.t
		(kg/ha)	(mm)	(%)	(%)	(%)	(kg/ha)	(%)	(kg/ha)	(kg/ha)	(%)	(kg/ha)
1993	Dec1,	12930	0	56	46	0	5690	50	3239	6980	50	3930

YR & DEK: date of planting; P.NBP: potential net biomass production; IRRI: irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for all individual crop development periods (M.p), or estimated over the total crop growing period (M.t); SURP: biomass reduction due to moisture surplus; NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP, NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t: yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

2.3.2 SETLAGOLE REPORT 2

CYSLAMB Report 7

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety	:	PAN473	Soil unit:	Cv	10%Clay
Produce		:	Grain	Soil textural class:	Medium	
Target plant density		:	14000 (/ha)	Soil drainage class:	Well	
Management system		:	Sample2b	Soil depth for Maize:	2.10 (m)	
Weed infestation		:	0% of max.	Water holding capacity:	148 (mm/m)	
Early ploughing from		:	SEP1 to SEP3	Residual water at JUL3:	-9 (mm)	
When topsoil storage		:	0 (mm)	Topsoil control depth:	0.50 (m)	
Planting opportunities		:		1 Available N (Undef.) :	-9 (ppm)	
Planting occurs from		:	NOV2 to NOV2	Available P (Bray-I):	23 (ppm)	
When topsoil storage		:	0 (mm)	Available K (Undef.) :	-9 (ppm)	
And dekad rainfall		:	0 (mm)	Weighted average pH-H2O:	6.6 (pH)	
Weeding occurs after		:	30 days	Weighted average ECe :	-9.0 (mS/cm)	
Irrigation capacity		:	0 (mm/day)	Weighted average ESP (%) :	-9 (%)	
Irrigation frequency		:	0.00(/dekad)	Weeds maximum evapotr.(%) :	%-9.00 x ETO	
Synoptic station		:	MADIBOGO	Weeds max. cover after :	-9 days	
Rainfall station		:	MADIBOGO	Range of rainfall years:	1994/1994	

(-9 = unknown / missing value)

CROP YIELD REDUCTION DUE TO MOISTURE STRESS

Method	Yield (t/ha)	Yield (t/ha)	Yield (t/ha)
Observed			
Long term			
Short term			

Yield loss due to moisture reduction, weighted by the 10 day plough period = 11%
Yield loss due to moisture reduction for the whole growing period = 14.4% x 100%

OVERALL RESULTS 1994 - 1995

CROP YIELD REDUCTION DUE TO THE SOIL

No available N (ppm)
Daily ETO (mm/day)
Soil depth (m)
Soil density (t/m³)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING CAPABILITY

Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield

Yield loss due to ploughing PAN473 (observed) = 11%
Yield loss due to ploughing PAN473 (observed) = 11%
Yield loss due to ploughing PAN473 (observed) = 11%
Yield loss due to ploughing PAN473 (observed) = 11%
Yield loss due to ploughing PAN473 (observed) = 11%
Yield loss due to ploughing PAN473 (observed) = 11%
Yield loss due to ploughing PAN473 (observed) = 11%
Yield loss due to ploughing PAN473 (observed) = 11%

SOIL MOISTURE BALANCE 1994/1995

DEK	ST.D	δST	RAIN	IRRI	MOIS	Eb	Etw	ETa	ST	MBRZ	Surpl	W.FR	ETm	STRESS
	(cm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(cm)	(mm)	(%)
³JUL2	50								0	0		0		
³JUL3	50		0		0	0			0	0	0	0		
³AUG1	50		0		0	0			0	0	0	0		
³AUG2	50		0		0	0			0	0	0	0		
³AUG3	50		0		0	0			0	0	0	0		
³SEP1	50		0		0	0			0	0	0	0		
³SEP2	50		0		0	0			0	0	0	0		
³SEP3	50		0		0	0			0	0	0	0		
³OCT1	50		0		0	0			0	0	0	0		
³OCT2	50		0		0	0			0	0	0	0		
³OCT3	50		3		3	3			0	0	0	0		
³NOV1	50		11		11	11			0	0	0	0		
ÝNOV2	19	15	22	0	37			32	5	0	0	18	35	9
ÝNOV3	39	0	0	0	5			4	1	0	0	18	36	89
ÝDEC1	58	0	4	0	5			3	2	0	0	18	34	91
ÝDEC2	77	0	2	0	4			2	2	0	0	18	36	94
ÝDEC3	97	0	22	0	24			12	12	0	0	18	41	71
ÝJAN1	116	0	0	0	12			5	7	0	0	18	44	89
ÝJAN2	135	0	71	0	78			30	48	0	0	53	42	29
ÝJAN3	154	0	13	0	61			21	40	0	0	53	39	46
ÝFEB1	174	0	8	0	48			15	33	0	0	53	38	61
ÝFEB2	193	0	0	0	33			9	24	0	0	53	38	76
ÝFEB3	210	0	0	0	24			6	18	0	0	53	38	84
ÝMAR1	210	0	0	0	18			5	13	0	0	53	35	86
ÝMAR2	210	0	0	0	13			3	10	0	0	53	33	91
ÝMAR3	210	0	66	0	76			19	57	0	0	53	29	34

DEK: dekad, ST.D: storage/rooting depth, δST: storage increase due to δST.D,
 RAIN: rainfall, IRRI: irrigation, MOIS: avail. Moisture, Eb: bare soil evap.,
 ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
 MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
 ETm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at NOV2 of 1994)

Period (days after planting)	26- 45	46- 70	71- 90	71-125	91-125	126-145
Crop biomass reduction	13%	15%		71%		11%

Total Crop biomass reduction, multiplied for the 4 individual periods = 81%
 Total Crop biomass reduction for the whole growing period (day 1-145) = 88%

OVERALL RESULTS 1994 - 1995

CROP BIOMASS REDUCTION, DUE TO THE SOIL

Nutrient status 0% (NUTRI)
 Salinity (ECe) 0% (SALIN)
 Sodicity (ESP) 0% (SODIC)
 Alkalinity (pH) 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP	IRRI	M.p	M.t	SURP	NBP.p	HI.p	YLD.p	NBP.t	HI.t	YLD.t
		(kg/ha)	(mm)	(%)	(%)	(%)	(kg/ha)	(%)	(kg/ha)	(kg/ha)	(%)	(kg/ha)
1994	Nov2,	13210	0	81	88	0	2510	49	1400	1590	48	840

YR & DEK: date of planting; P.NBP: potential net biomass production; IRRI: irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for all individual crop development periods (M.p), or estimated over the total crop growing period (M.t); SURP: biomass reduction due to moisture surplus; NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP, NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t: yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

3.2.3 SETLAGOLE REPORT 3

CYSLAMB Report 8

SUMMARY OF CHARACTERISTICS EVALUATED:

Crop: Maize	Variety :	PAN473	Soil unit	:	Cv	10%Clay
Produce	:	Grain	Soil textural class	:	Medium	
Target plant density	:	14000 (/ha)	Soil drainage class	:	Well	
Management system	:	Sample2b	Soil depth for Maize	:	2.10 (m)	
Weed infestation	:	0% of max.	Water holding capacity	:	148 (mm/m)	
Early ploughing from	:	SEP1 to SEP3	Residual water at JUL3	:	-9 (mm)	
When topsoil storage	:	0 (mm)	Topsoil control depth	:	0.50 (m)	
Planting opportunities	:		1 Available N (Undef.)	:	-9 (ppm)	
Planting occurs from	:	NOV2 to NOV2	Available P (Bray-I)	:	23 (ppm)	
When topsoil storage	:	0 (mm)	Available K (Undef.)	:	-9 (ppm)	
And dekad rainfall	:	0 (mm)	Weighted average pH-H2O	:	6.6 (pH)	
Weeding occurs after	:	30 days	Weighted average ECe	:	-9.0 (mS/cm)	
Irrigation capacity	:	0 (mm/day)	Weighted average ESP	:	-9 (%)	
Irrigation frequency	:	0.00(/dekad)	Weeds maximum evapotr. (%)	:	%-9.00 x ET0	
Synoptic station	:	MADIBOGO	Weeds max. cover after	:	-9 days	
Rainfall station	:	MADIBOGO	Range of rainfall years	:	1995/1995	

(-9 = unknown / missing value)

APPENDIX 3
 SOIL MOISTURE BALANCE 1995/1996

DEK	ST.D	δ ST	RAIN	IRRI	MOIS	Eb	ETw	ETa	ST	MBRZ	Surpl	W.FR	ETm	STRESS
	(cm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(cm)	(mm)	(%)
³ JUL2	50								0	0		0		
³ JUL3	50		0		0	0			0	0	0	0		
³ AUG1	50		0		0	0			0	0	0	0		
³ AUG2	50		0		0	0			0	0	0	0		
³ AUG3	50		0		0	0			0	0	0	0		
³ SEP1	50		0		0	0			0	0	0	0		
³ SEP2	50		30		30	14			16	0	0	20		
³ SEP3	50		0		16	14			2	0	0	20		
³ OCT1	50		1		3	3			0	0	0	0		
³ OCT2	50		45		45	39			6	0	0	30		
³ OCT3	50		26		32	32			0	0	0	0		
³ NOV1	50		4		4	4			0	0	0	0		
YNOV2	19	0	20	0	20			19	1	0	0	14	35	46
YNOV3	39	0	4	0	5			4	1	0	0	14	36	89
YDEC1	58	0	70	0	71			34	37	0	0	48	34	0
YDEC2	77	0	94	0	131			36	95	0	0	76	36	0
YDEC3	97	0	0	0	95			41	54	0	0	76	41	0
YJAN1	116	0	30	0	84			37	47	0	0	76	44	16
YJAN2	135	0	22	0	69			27	42	0	0	76	42	36
YJAN3	154	0	53	0	95			33	62	0	0	76	39	15
YFEB1	174	0	0	0	62			19	43	0	0	76	38	50
YFEB2	193	0	16	0	59			17	42	0	0	76	38	55
YFEB3	210	0	37	0	79			21	58	0	0	76	38	45
YMAR1	210	0	72	0	130			33	97	0	0	88	35	6
YMAR2	210	0	0	0	97			25	72	0	0	88	33	24
YMAR3	210	0	17	0	89			22	67	0	0	88	29	24

DEK: dekad, ST.D: storage/rooting depth, δ ST: storage increase due to δ ST.D,
 RAIN: rainfall, IRRI: irrigation, MOIS: avail. Moisture, Eb: bare soil evap.,
 ETw: weed evapotransp., ETa: crop evapotransp., ST: rest moisture up to ST.D,
 MBRZ: rest moisture below ST.D, Surpl: moisture surplus, W.FR: wetting front,
 ETm: maximum crop evapotransp., STRESS: crop moisture stress in current DEK.

CROP BIOMASS REDUCTION DUE TO MOISTURE STRESS: (planting at NOV2 of 1995)

Period (days after planting)	26-45	46- 70	71- 90	71-125	91-125	126-145
Crop biomass reduction	0%	5%	23%	-	17%	5%

Total Crop biomass reduction, multiplied for the 5 individual periods = **42%**
 Total Crop biomass reduction for the whole growing period (day 1-145) = 38%

OVERALL RESULTS 1995 - 1996

CROP BIOMASS REDUCTION, DUE TO THE SOIL Nutrient status: 0% (NUTRI)
 Salinity (ECe): 0% (SALIN)
 Sodicity (ESP): 0% (SODIC)
 Alkalinity (pH): 0% (ALKAL)

CROP PRODUCTION FIGURES PER IDENTIFIED PLANTING OPPORTUNITY:

YR	DEK	P.NBP	IRRI	M.p	M.t	SURP	NBP.p	HI.p	YLD.p	NBP.t	HI.t	YLD.t
		(kg/ha)	(mm)	(%)	(%)	(%)	(kg/ha)	(%)	(kg/ha)	(kg/ha)	(%)	(kg/ha)
1995	Nov2,	13210	0	42	38	0	7660	50	4350	8190	50	4670

YR & DEK: date of planting; P.NBP: potential net biomass production; IRRI: irrigation; M.p/t: biomass reduction due to moisture stress, multiplied for all individual crop development periods (M.p), or estimated over the total crop growing period (M.t); SURP: biomass reduction due to moisture surplus; NBP.p/t: net biomass production, after correcting P.NBP for M.p/t, SURP, NUTRI, SALIN, SODIC and ALKAL; HI.p/t: harvest index for NBP.p/t; YLD.p/t: yield, harvested from NBP.p/t (moisture content of harvested produce is 12%).

APPENDIX 3

FARM RECORDS CHECKLIST FOR NW PROVINCE

Long-term farm data on:

- Total farm arable area allocated for maize (optional)
- Long term average crop yield per soil type
- Farm management:
 - -Rainfed/ Irrigated
 - -Maize variety
 - -Plant density (highest, normal, lowest)
 - -Ploughing and planting dates (earliest, normal, latest)
 - -Duration of the ploughing and planting period (No. of weeks)
 - -Weed occurrence and control techniques
 - -Plant disease occurrence and control techniques
 - -Soil fertilization and fertilization timing
- Soils:
 - Types of soils occurring in the farm
 - -Soil depth
 - -Water holding capacity
 - -Textural and drainage class of different soils

2. FARMER'S PERSONAL EXPERIENCE:

2.1 About crop production (maize) in the region

- 2.1.1 Maize varieties that they use, why and how long have they been using it.
- 2.1.2 Production opportunities offered by the particular cultivars
- 2.1.3 Constraints imposed by those cultivars and how do they deal with those?
- 2.1.4 Have they been successful over the years? To what extent?
- 2.1.5 how much yield (t.ha⁻¹ or no. of bags) do they regard to be the best, better or bad?
- 2.1.6 How often to they normally get each of the above?
- 2.1.7 At which stage is their crop more sensitive to stressful conditions and how do they manage that?

2.2 About climate in the region

- 2.2.1 How has it been affecting their production over the years
- 2.2.2 Opportunities and constraints imposed by climatic conditions in the region.
- 2.2.3 Strategies adopted to counteract the constraints
- 2.2.4 How do they differentiate between climatic good and bad years

2.3 About the soils in his farm

- 2.3.1 Which type of fertilizer do they normally apply, why, how and when?
- 2.3.2 Productivity of soils in each farm as compared to the neighbors, why?
- 2.3.3 General performance of different soils and their unique qualities.

APPENDIX 4

SIMULATED MAIZE YIELD AT DIFFERENT PLANT POPULATIONS OBTAINABLE AT DIFFERENT PLANTING DATES IN POTCHEFSTROOM AND MMABATHO

Table 11 simulated maize yield at different plant populations, during Nov3, Dec1 and Dec2 dekads. 1942-1997, Potchefstroom

Nov3, 1942-1997,											
Run	Pl.dens. (/ha)	YLD.p (kg/ha) probability					YLD.t (kg/ha) probability				
		Max.	75%	50%	25%	Min.	Max.	75%	50%	25%	Min.
1	10000	920	2430	5000	6150	6760	320	3380	5000	5540	6480
2	12000	960	2460	5160	6350	6980	320	3490	5160	5730	6700
3	14000	970	2540	5340	6560	7210	330	3610	5340	5910	6920
4	16000	710	2330	4760	6320	7440	0	2770	5350	5950	7140
5	18000	260	1100	2250	3150	6970	0	1580	3380	4440	7050
6	20000	270	1130	2320	3250	7170	0	1620	3470	4570	7250
7	22000	270	1170	2380	3340	7380	0	1660	3570	4600	7450
8	24000	280	1200	2440	3420	7570	0	1670	3670	4730	7650
9	26000	280	1230	2510	3510	7760	0	1720	3760	4850	7850
10	28000	290	1260	2570	3600	7950	0	1760	3850	4970	8040
11	30000	290	1260	2630	3690	8140	0	1810	3950	5090	8230
Dec2, 1942-1997											
Run	Pl.dens. (/ha)	YLD.p (kg/ha) probability					YLD.t (kg/ha) probability				
		Max.	75%	50%	25%	Min.	Max.	75%	50%	25%	Min.
1	10000	310	2640	4490	5950	6610	1160	3040	4690	5420	6150
2	12000	310	2730	4640	6150	6830	1200	3140	4850	5600	6350
3	14000	320	2760	4800	6350	7050	1240	3240	5010	5780	6560
4	16000	180	1850	4070	6550	7270	840	2850	5020	6110	7060
5	18000	0	1150	1980	3310	7190	0	1470	3160	4420	7270
6	20000	0	1180	2040	3400	7400	0	1510	3250	4550	7480
7	22000	0	1220	2090	3490	7600	0	1520	3340	4580	7680
8	24000	0	1250	2150	3590	7810	0	1560	3420	4700	7890
9	26000	0	1280	2210	3680	8010	0	1600	3510	4820	8090
10	28000	0	1310	2260	3770	8200	0	1640	3600	4940	8290
11	30000	0	1340	2320	3860	8400	0	1680	3690	5060	8490
Dec3, 1947-97											
Run	Pl.dens. (/ha)	YLD.p (kg/ha planted) probability					YLD.t (kg/ha planted) probability				
		Max.	75%	50%	25%	Min.	Max.	75%	50%	25%	Min.
1	10000	50	1730	4190	6340	6540	0	2120	4580	5630	6150
2	12000	40	1790	4330	6560	6760	0	2190	4730	5810	6360
3	14000	40	1850	4470	6770	6980	0	2260	4890	6010	6560
4	16000	40	1620	3740	6630	7200	0	2040	4390	6410	7060
5	18000	0	770	1960	2980	6380	0	700	2690	4380	6820
6	20000	0	790	2020	3070	6560	0	720	2770	4410	7020
7	22000	0	810	2080	3150	6740	0	740	2850	4530	7220
8	24000	0	830	2130	3240	6930	0	760	2920	4660	7410
9	26000	0	850	2180	3320	7100	0	760	3000	4770	7600
10	28000	0	880	2240	3400	7280	0	780	3070	4890	7780
11	30000	0	880	2290	3480	7450	0	800	3140	5010	7970

Table 12 simulated maize yield at different plant populations, during Nov1, Nov2 and Nov3 dekads. 1985-91997 Mmabatho

Nov1,											
Run	Pl.dens. (/ha)	YLD.p (kg/ha) probability					YLD.t (kg/ha) probability				
		Max	75%	50%	25%	Min	Max	75%	50%	25%	Min
1	10000	890	1020	2780	3970	4250	600	2050	2510	3550	4180
2	12000	920	1060	2880	4110	4390	620	2120	2540	3680	4320
3	13000	920	1070	2870	4180	4470	630	2150	2580	3730	4390
4	14000	930	1100	2920	4240	4540	640	2190	2630	3800	4470
5	15000	730	800	2150	3030	3780	200	1630	2000	3630	3780
6	16000	740	810	2180	3080	3840	200	1650	2030	3680	3840
7	17000	750	820	2220	3130	3900	200	1680	2060	3660	3900
8	18000	360	360	910	1390	2320	0	200	430	1550	2400
9	19000	360	360	920	1410	2360	0	200	440	1570	2430
10	20000	360	360	940	1410	2390	0	200	440	1590	2470

Nov2,											
Run	Pl.dens (/ha)	YLD.p (kg/ha) probability					YLD.t (kg/ha) probability				
		Max.	75%	50%	25%	Min.	Max.	75%	50%	25%	Min.
1	10000	750	1090	3180	4840	6290	530	1560	2700	4150	5670
2	12000	750	1120	3290	5010	6510	550	1610	2790	4290	5860
3	13000	770	1140	3340	5090	6610	540	1640	2780	4360	5960
4	14000	780	1160	3400	5160	6720	560	1660	2820	4430	6050
5	15000	570	790	2350	4800	5320	200	1080	2280	4050	5690
6	16000	570	800	2390	4880	5400	190	1100	2310	4110	5780
7	17000	580	820	2420	4940	5490	200	1110	2350	4170	5880
8	18000	270	350	1050	2230	2460	0	0	830	2460	3690
9	19000	270	360	1070	2260	2490	0	0	840	2490	3740
10	20000	280	360	1090	2290	2530	0	0	830	2530	3800

Nov3,											
Run	Pl.dens. (/ha)	YLD.p (kg/ha) probability					YLD.t (kg/ha) probability				
		Max.	75%	50%	25%	Min.	Max.	75%	50%	25%	Min.
1	10000	1540	1540	3350	4230	6350	1740	1740	4100	4160	5810
2	12000	1590	1590	3460	4380	6570	1800	1800	4240	4310	6010
3	13000	1620	1620	3520	4450	6680	1830	1830	4310	4380	6100
4	14000	1640	1640	3570	4520	6780	1860	1860	4380	4450	6200
5	15000	1380	1380	2390	2980	5480	1310	1310	3560	3560	6000
6	16000	1400	1400	2430	3020	5570	1330	1330	3540	3540	6090
7	17000	1420	1420	2470	3070	5650	1350	1350	3590	3590	6190
8	18000	660	660	890	1270	3190	0	0	1440	1520	4110
9	19000	660	660	910	1280	3240	0	0	1460	1540	4080
10	20000	670	670	920	1300	3280	0	0	1490	1560	4140