## COVER CROPS SPECIES (Agronomic Protocol)

Adapted from: CALEGARI, A.; TAIMO, J.P.C. Practical Guide of Conservation Agriculture. Austrian Cooperation and Ministry of Agriculture, Sofala, Mozambique, 2006, 106 p. (in Portuguese).

Scientific Name	Common Name	Seeds/ meter into the row (single cron)	Distance between rows (cm)	Planting season (rain season)	Main advantages and alternatives of use	Dry mass production	Management
Canavalia brasiliensis	Brave of Ceará beans	6-10	50-100	Warm	Legume that grows in soil of medium fertility, supports very dry conditions (after root development), allelopathic effects on weeds, nitrogen fixation and nutrient recycling. Undetermined plant that covers very well the soil surface. Good effects for maize, rice, sorghum, millet, beans, cotton, etc.	5-7 tons/ha	Knife-roller at the flowering stage, slash, herbicides.
Canavalia ensiformis	Jack bean	6-10	30-50	Warm	Can develop in soil with low fertility, supports dry conditions, allelopathic effects on many weeds; nitrogen fixation, nutrients recycling. The seed sizes are big, and many times can be difficult to use.	5 – 6 tons/ha	Knife-roller at the flowering stage, slash, herbicides

Scientific	Common	Seeds/	Distance	Planting	Main advantages and alternatives of use	Dry mass	Management
Name	Name	meter	between	season		production	_
		into the row	rows	(rain		_	
		(single	(cm)	season)			
		crop)					
Pennisetum glaucum	Pearl millet	12-15	17-25	Warm	Can develop in soil with medium fertility, support dry conditions; strong allelopathic effects on many weeds; high biomass production and great capacity of K recycling. Strong root system that can achieve around 2-3 m soil depth. Promote soil biodiversity and this can decrease soil pathogens populations ( <i>Fusarium</i> sp., <i>Sclerotinia sclerotiorum</i> ; etc.). It can de used mixed with legumes such as crotalarias, cowpea, etc. It can be sowed isolated and/or oversowing on sovhean maize bean (around 20-30)	8-10 tons/ha	herbicide
					days before harvesting). Also it can be used as a forage for animas grazing and after it regrow and used as a soil covering.		
Setaria italica	Moha grass – IAPAR	40-50	20-40	Warm	Grows fast (40-50 days after planting can be managed); develops in medium fertile soil; high soil protection; good weed control; can decrease the soil nematode population ( <i>Meloidogyne incognita</i> ); high nutrient recycling; favourable soil physical effects of root system. Forage for grazing animals and re- growth potential.	3 – 4.5 tons/ha	Slash, herbicides
Eleusine coracana	Giant chicken foot grass	50-70	20-40	Warm	Grows quite fast; develops in medium fertile soil; high soil protection; allelopathic effects on weeds; high nutrient recycling; important physical effects of root system (that can produce more than 5 tons./hectare). Excellent for animals grazing and re- growth potential.	4 – 10 tons/ha	Slash, herbicides

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Name	Name	meter	between	season		production	
		into the row	rows	(rain			
		(single	( <b>cm</b> )	season)			
		crop)					
Cajanus cajan	Pigeon pea	20-25	30-50	Warm	Grows well in acid soil of low fertility; strong root	3 - 12	Slash, knife-
					system for breaking compacted layers that can attain	tons/ha	roller at the
					more than 3 meters in depth; good soil protection;		flowering stage,
					allelopathic effects on weeds; high nitrogen fixation,		herbicides
					nutrients recycling and increases phosphorus		
					availability. Excellent forage for animals grazing		
					with high protein content and also with re-growth		
					potential. Can be used in a protein "bank" for		
					animals and also as a wind-break.		<u> </u>
Cajanus cajan	Dwarf	20-25	30-50	Warm	Grows well in soil of low/medium fertility; good	2-8 tons/ha	Slash, knife-
	pigeon pea				root system for breaking compacted layers that can		roller at the
					attain more than I meter in depth; good soil		flowering stage,
					protection; allelopathic effects on weeds; high		nerbicides
					như gen fixation, nutrent recycling and increases		
					grazing with high protein content		
Мионта	Plack	7 10	40.60	Worm	Grows well in acid soil of low fertility: good root	2.5  tong/hg	Knife roller at
mucuna	DIACK	7-10	40-00	vv ar m	system excellent soil protection: allelopathic effects	2 - 5 tons/na	flowering stage
pruriens	mucuna				on many weeds: high nitrogen fixation nutrient		and beginning
	var.				recycling. Can decrease the phyto-nematode		of the pods
					population in the soil. Forage and toasted grains can		stage, slash.
					be used as animal fodder, and also the grains		herbicides
					properly toasted can be used by humans (to make		
					biscuits, cake, coffee, etc.).		

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		into the row	rows	(rain			
		(single	(cm)	season)			
		crop)					
Mucuna pruriens	Grey mucuna	7-10	40-60	Warm	Grows well in soil of medium/low fertility; good root system, excellent soil protection; allelopathic	2-6 tons/ha	Knife-roller at the flowering
P	var				effects on many weeds; high nitrogen fixation,		stage and
	, cui .				nutrient recycling. Can decrease the phyto-nematode		beginning of
					population in the soil. This species normally		the pods
					presents resistance to Fusariosis sp. and also for		formation,
					some viruses. Forage and toasted grains can be used		slash,
					as animal fodder, and also the grains properly		herbicides
					toasted can be used by humans (to make biscuits,		
					cake, coffee, etc.).		
Mucuna	Dwarf	10-12	40-60	Warm	Grows well in soil of medium/high fertility; good	2-4 tons/ha	Knife-roller at
pruriens	mucuna				root system; presents a determined growth habit and		the flowering
	var.				good soil protection; some allelopathic effects on		stage and
					many weeds; nitrogen fixation, nutrient recycling.		beginning of
					Can decrease the phyto-hematode population in the		the pods
					soli. Folage and close the grains can be used as		sleeb
					can be used by humans (to make biscuits cake		berbicides
					coffee etc.)		nerbieldes
Crotalaria	Sunhemp	20-30	20-40	Warm	Very fast growth covering the soil: grows well in	3-12	Knife-roller at
iuncea	Sumenip	20.50	20 10	vv urm	soil of medium fertility: allelopathic effects on many	tons/ha	the flowering
junceu					weeds, nitrogen fixation, nutrient recycling, Good	10115/ Hd	stage, slash
					nematode control; forage can be used as animal		
					fodder.		
Crotalaria	Crotalaria	20-40	30-50	Warm	Grows well in soil of medium fertility; some	2-6 tons/ha	Knife-roller at
ochroleuca	ochroleuca				allelopathic effects on many weeds, nitrogen		the flowering
					fixation, nutrient recycling.		stage, slash

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		(single	(cm)	season)			
		crop)					
Crotalaria	Crotalaria	20-40	30-50	Warm	Grows well in soil of medium fertility; some	2-4 tons/ha	Knife-roller at
lanceolata	lanceolata				allelopathic effects on many weeds, nitrogen		the flowering
					fixation, nutrient recycling.		stage, slash
Crotalaria	Crotalaria	20-40	30-50	Warm	Grows well in soil of medium fertility; allelopathic	2-4 tons/ha	Knife-roller at
spectabilis	spectabilis				effects on many weeds, nitrogen fixation, nutrient		the flowering
*	-				recycling. Good nematode control.		stage, slash
Crotalaria	Crotalaria	20-40	30-50	Warm	Good development in soil of medium fertility; some	2-4 tons/ha	Knife-roller at
grantiana	grantiana				allelopathic effects on many weeds, nitrogen		the flowering
	-				fixation, nutrient recycling.		stage, slash
Arachis	Horse	15-20	40-60	Warm	Grows well in soil with medium fertility; good soil	3-5 tons/ha	Normally, the
hypogaea	groundnuts				protection with high weed control; nitrogen fixation,	(forage or	grains are
	_				nutrient recycling; good nematode control; grains for	residues)	harvested, the
					human and animal food; forage or residues can be	,	residues
					used as animals fodder.		remaining on
							the soil
Dolichos lab	Lablab	15-25	30-50	Warm	Can develop in soil with medium/ low fertility,	3-6 tons/ha	Knife-roller at
lab					supports some dry conditions, allelopathic effects on		the flowering
					many weeds; nitrogen fixation, nutrient recycling.		stage, slash,
					Can multiply some soil nematodes. Forage and		herbicides
					grains can be used as animals fodder. Be careful		
					with the seed storage as they are easily attacked by		
					seed pests.		
Avena	Black oat	40-55	20-40	Cold	Grows in soil with medium fertility; good soil cover;	3-8 tons/ha	Knife-roller
strigosa	– IAPAR				good allelopathic effects on weeds; good root		when the grains
	61				system; high nutrient recycling; long cycle and good		are at the milk
					forage that permits 2 cuts or grazing, and re-growth		stage, slash,
					again to cover the soil.		herbicides

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		crop)					
Avena sativa	White oat	45-65	20-40	Cold	Grows in soil with medium/high fertility; good soil	3-6 tons/ha	Normally the
	– UFRGS				cover; good allelopathic effects on weeds; high		grains are
	19				nutrient recycling; good forage that permit 2 cuts or		harvested;
					grazing, and re-growth again to cover the soil.		Knife-roller
							when the grains
							are at the milk
							stage, slash,
							herbicides.
Secale cereale	Rye –	40-50	20-40	Cold	Develops in acid soil with low fertility; good soil	3-8 tons/ha	The grains can
	IAPAR				cover; good allelopathic effects on weeds; excellent		be harvested;
	PG 950				root system; high capacity for nutrient recycling;		knife-roller
					good forage that permits 2 cuts or grazing, and re-		when the grains
					growth again to cover the soil. Can be mixed with		are at the milk
					oats for forage. Can be used as forage, and after that,		stage, slash,
7 11	D (	50.70	20.20	<u> </u>	it can re-grown and produce seeds.	2 5 1	herbicides.
Lollium	Raygrás	50-70	20-30	Cold	Normally, it grows well in soil with medium	2-6 tons/ha	Slash,
multiflorum					fertility; good soil cover; good allelopathic effects		herbicides
					on weeds; good root system that can increase soil		
					aggregation; high nutrient recycling; good forage		
					that permit 2 cuts or grazing, and re-growth again to		
					cover the soil. Can be mixed with rye and also with		
					oats for forage.		

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		crop)					
X	Triticale	45-60	20-40	Cold	Grows in soil with low/ medium fertility; good soil	3-5 tons/ha	Knife-roller
Triticosecale					cover; good allelopathic effects on weeds; well		when the grains
					developed root system; high nutrient recycling;		are at the milk
					good forage that permit 2 cuts or grazing, and re-		stage
					growth again to cover the soil. Can be used by		
					lorage, and after that, it can re-grown and produce		
Danhanya	Oil good	10.25	20.40	Cold	Grous in soil with medium fortility, good soil cover	2 Otoma/ha	Knife roller et
Kapnanus	Ull seeu	10-23	20-40	Cold	good allelonathic effects on weeds: some varieties	5 - 9 tons/na	the flowering
sativus	radish				have a very strong root system that can break some		stage slash
					compacted layers: high nutrient recycling (mainly		herbicides
					nitrogen and phosphorus), good forage that permit ?		nerorendes.
					cuts or grazing and re-growth again to cover the		
					soil. Can be mixed with oats, rve, or triticale and		
					used as forage for animal fodder, after that it can re-		
					grow and cover the soil. In some areas it is		
					recommended to be mixed with a grass to produce a		
					mulch with a high C:N ratio, remaining more time		
					covering the soil.		
Lupinus albus	White	15-20	20-50	Cold	Grows in soil with low/ medium fertility; good soil	3-6 tons/ha	Knife-roller
	lupin				cover; the good root system can break compacted		when the plants
					layers; nitrogen fixation and high nutrient recycling;		are on the
					Can be mixed with oats, rye, millet, sorghum, radish		second to third
					and other cover crops species.		flowering stage,
							slash,
							herbicides.

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		crop)					
Lupinus	Blue lupin	15-20	20-50	Cold	Grows in soil with low/ medium fertility; good soil	3-6 tons/ha	Knife-roller
angustifolius	– IAPAR				cover; the good root system can break compacted		when the plants
	24				layers; nitrogen fixation and high nutrient recycling;		are on the
					It can be mixed with oats, rye, triticale, millet,		second to third
					sorghum, radish and other cover crops species.		flowering stage,
							slash,
							herbicides.
Vicia sativa	Common	18-25	20-40	Cold	Plant exigent in calcium and phosphorus, it doesn't	2-5 tons/ha	Knife-roller at
	vetch				grow in acid soils; good soil cover; high nitrogen		the flowering
					fixation and good nutrient recycling; Can be mixed		stage, slash and
					with oats, rye, millet, sorghum and other grasses,		herbicides
					radish and other cover crops species. Can be used		
					for animal grazing		
Vicia villosa	Hairy	18-25	20-40	Cold	Wild plant that can grows in very acid and depleted	3-6 tons/ha	Knife-roller at
	vetch				soils, with low content of organic matter,		the flowering
					phosphorus and calcium; good soil cover; high		stage, slash,
					nitrogen fixation and good nutrient recycling; Can		herbicides.
					be mixed with oats, rye, millet, sorghum and other		
					grasses, radish and other cover crops species. Can be		
					used for animal grazing, and re-grows to cover the		
					soil. Long cycle.		

Scientific Name	Common Name	Seeds/ meter into the row (single	Distance between rows (cm)	Planting season (rain season)	Main advantages and alternatives of use	Dry mass production	Management
		crop)					
Pisum sativum subesp. arvense	Field pea – IAPAR 83	15-25	20-50	Cold	Plant that presents fast growth, develops in soil with medium fertility; good soil cover; high nitrogen fixation and good nutrient recycling; Can be mixed with oats, rye, millet, sorghum and other grasses, radish and other cover crops species. Can be used for animal grazing, re-grows again and can remain covering the soil. The seeds when they are green can be used as human food, for animals the dry seeds must be toasted to eliminate some undesirable compounds.	3 – 7 tons/ha	Knife-roller at the flowering stage, slash, herbicides.