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INTRODUCTION, SELECTION AND EVALUATION OF ANNUAL SOWN FORAGE LEGUMES UNDER CONTINENTAL MEDITERRANEAN CLIMATIC CONDITIONS IN PAKISTAN

by

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INTRODUCTION, SELECTION AND EVALUATION OF ANNUAL SOWN FORAGE LEGUMES UNDER CONTINENTAL MEDITERRANEAN CLIMATIC CONDITIONS IN PAKISTAN

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SUMMARY

The upland areas (>1000 m) of Baluchistan Province of Pakistan experience a continental semi-arid Mediterranean climate. The dominant farming system is the production of range-fed small ruminants which have substantially increased in numbers recently. As a result excessive overgrazing of rangelands has occurred and periods of acute feed deficit are recurrently experienced.

In an attempt to provide additional animal feed from dryland forage crops to meet these periods of deficit, annual sown forage legumes have been tested for adaptability to the harsh and variable environmental conditions experienced. Vicia villosa ssp. dasycarpa has proved to be hyper-cold tolerant and relatively productive when sown in autumn at elevations above 1300 m. Autumn sowing in warmer locations (<1300 m) favours the production of V. ervilia. When spring planting is the only available option to farmers, production is generally much lower and V. villosa and Lathyrus sativus appear to be the most productive species.

INTRODUCTION

The upland areas (>1000 m) of Baluchistan Province in Pakistan (Latitude 28-32°N) experience a continental semi-arid Mediterranean climate with some irregular additions of summer monsoonal rainfall. The current farming systems rely on the production of small ruminants from degraded Artemesia and Chrysapogon sp. rangeland and subsistence cropping of wheat/fallow rotations (ICARDA, 1988). Sheep and goat numbers in Baluchistan have increased since 1955 from approximately two to thirteen million head in 1986 (ICARDA, 1988). This has resulted in severely overgrazed rangelands and periodic acute feed deficits. In response the Arid Zone Research Institute has initiated a program for the introduction and screening of new forage and range species into the local farming systems. The forage crop component of this program which is reported in this paper has the dual objectives of (a) intensifying and diversifying crop production and (b) producing animal feed for periods of critical shortage and thereby reducing the current severe overgrazing on natural rangelands. Annual sown forage legumes principally Vicia and Lathyrus sp. have been the initial candidates for introduction. The acute severity of the winter season in upland Baluchistan requires species either to be very frost tolerant or to be of a sufficiently short maturity period to allow the growth cycle to be completed between February and mid-May when intense heat and drought stresses terminate rainfed crop growth.

METHODOLOGY

Following an initial exploratory trial planted at a single location in 1985-86, trials were planted in two cropping years 1986-87 and 1987-88 at two planting times (October and February) and at three locations Quetta (QU), Khuzdar (KZ) and Kan Mehtarzai (KM). The planting times and locations were selected to cover the two biologically possible planting windows and a representative range of elevations typical of upland Baluchistan (1100-2200 m). Where no summer monsoonal rain was received to allow germination pre-planting supplemental irrigation was used to mimic a 30 mm rainfall. If crop mortality due to drought was about to occur small amounts of supplemental irrigation were used to permit crop survival and seed set (Table 1). All trials were planted as small plots (1.5 x 5m) in randomized block designs with three replications with at least 18 lines tested per site/seeding date combination. The principal constraints to crop growth were environmental (temperature and moisture supply) and other factors such as soil fertility status, crop diseases or insects were not seen to have a major influence on productivity. Specific lines of five crop species that were grown in common across all locations and years have been selected for reporting. The local lentil landrace (Lens culinaris) was selected as the check in these trials as no appropriate species of annual sown forage legume is grown.

RESULTS

Full details of total dry matter and seed yields at all year/planting time/location combinations are shown in Table 1.

Climatic conditions in the 1985-86 and 1987-88 crop seasons were unfavourable to growth with total annual rainfall (Table 1) being around or below 200 mm. Rainfall distribution was also poor, with little rain being received in the latter half of the growing season (April onwards) which seriously reduced the yields of spring planted crops. Air temperatures in winter were not as severely damaging as in the 1986-87 season. In the 1986-87 season winter air temperatures were low enough (at least to -19°C) to severely damage crops at Kan Mehtarzai (elevation 2230 m) and Quetta (elevation 1750 m) but to a much lesser extent at Khuzdar (elevation 1150 m). In direct contrast the total rainfall received at all sites was above average with a favourable distribution allowing early planting and with substantial falls occurring late in the season (ICARDA, 1988).

DISCUSSION

From the data presented in Table 1 it is evident that where and when planting on residual summer monsoonal moisture is possible then this is a more productive option than spring planting. However, unless the location is at a low elevation (<1300 m) such as Khuzdar only hyper-cold tolerant species will be consistently productive. V. Villosa ssp. dasycarpa Acc. 683 (V.das.) appears to have equal cold tolerance to the very hardy local lentil control but when average or better rainfall is received (such as in 1986-87), it can be severalfold more productive in dry matter terms. V. ervilia Acc. 2542 (V.erv.) shows promise when planted in autumn but only at the locations with guaranteed mild winters such as Khuzdar. The comparatively high seed yields with this species could be a factor of attraction to farmers.

When spring planting is the only available option to farmers, a condition likely to recur in perhaps at least half of all years averaging over sites (ICARDA, 1988), choices between species are less clear cut. However, as a general observation from the data presented in Table 1, the introduced species have been in many instances more productive than the local lentil control, this indicates the potential acceptability of new species by farmers. In a year with a favourable distribution of rain and an above average total V.v. dasycarpa showed good productivity in at

least two locations in 1986/87. In a very dry year such as 1987/88 Lathyrus sativus Acc. 3 (L.sat.) perhaps shows the most promise. The yields reported are extremely low but should not be disregarded as irrelevant. It is in precisely such a year that feed demands for survival of the normally range fed sheep reach a maximum.

REFERENCES

INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN DRY AREAS (ICARDA) (1988). High elevation research in Pakistan: the MART/AZR Project. ICARDA Research Report 127, ICARDA, Aleppo, Syria.

Table 1.

		TOTAL DRY MATTER (Kg/ha)					SEED YIELD (Kg/ha)				
	EMERGE	PRE-WINTER		SPRING	EMERGE		PRE-WINTER		SPRING	EMERGE	
	SEASON	86/7	87/8	85/6	86/7	87/8	86/7	87/8	85/6	86/7	87/8
	Sp.										
QU	V.sat.*	2750	669	290	2167	548	493	58	92	833	187
	V.erv.	0	969	529	2208	294	0	225	199	824	118
	V.das.	8375	1244	467	3433	131	1173	10	119	851	14
	L.sat.	0	1194	389	1792	434	0	42	134	721	156
	Lentil	3542	701	188	1042	101	426	12	28	321	0
	SE,cv*	354,48	205,84	65,43	260,22	43,34	72,68	16,87	26,68	84,25	16,64
	Rain*	238+50	148+50	202	238+30	148+50					
	Mn.T*	-16	-7	-7	-2.5	-0.3					
KZ	V.sat.	875	625		1709	617	20	195		218	7
	V.erv.	3969	1033		1708	333	799	435		200	6
	V.das.	5063	544		3750	633	631	123		385	1
	L.sat.	1688	974		1833	783	176	341		282	120
	Lent.	1157	475		1000	350	130	95		97	1
	SE,cv*	367,44	147,44		321,28	176,61	48,53	57,87		41,10	14,142
	Rain*	548*R	32+150		548*R	32+150					
	Mn.T*	0	-5		2	-1					
KM	V.sat.	0	229		667	400	0	85		251	125
	V.erv.	0	224		333	267	0	94		140	65
	V.das.	5817	238		333	617	1140	64		64	168
	L.sat.	0	200		583	950	0	68		236	407
	Lent.	2417	424		417	750	318	54		154	18
	SE,cv*	-,-	59,34		130,36	117,32	-,-	20,47		43,45	33,45
	Rain*	170+50	66+100		170+50	66+150					
	Mn.T*	-19	-12		-4	-3					

* Notes

1. V.sat. = Vicia sativa Acc. 2541.
2. SE,CV = Standard error and coefficient of variation %.
3. Rain = Seasonal precipitation July-June (mm) + supplemental irrigation (mm).
4. R = Substantial runoff occurred but was unquantifiable.
5. Mn.T = Seasonal absolute minimum air temperature (degrees C).