

Seed Storage Effects on Germination of Two Forage Kochia Cultivars

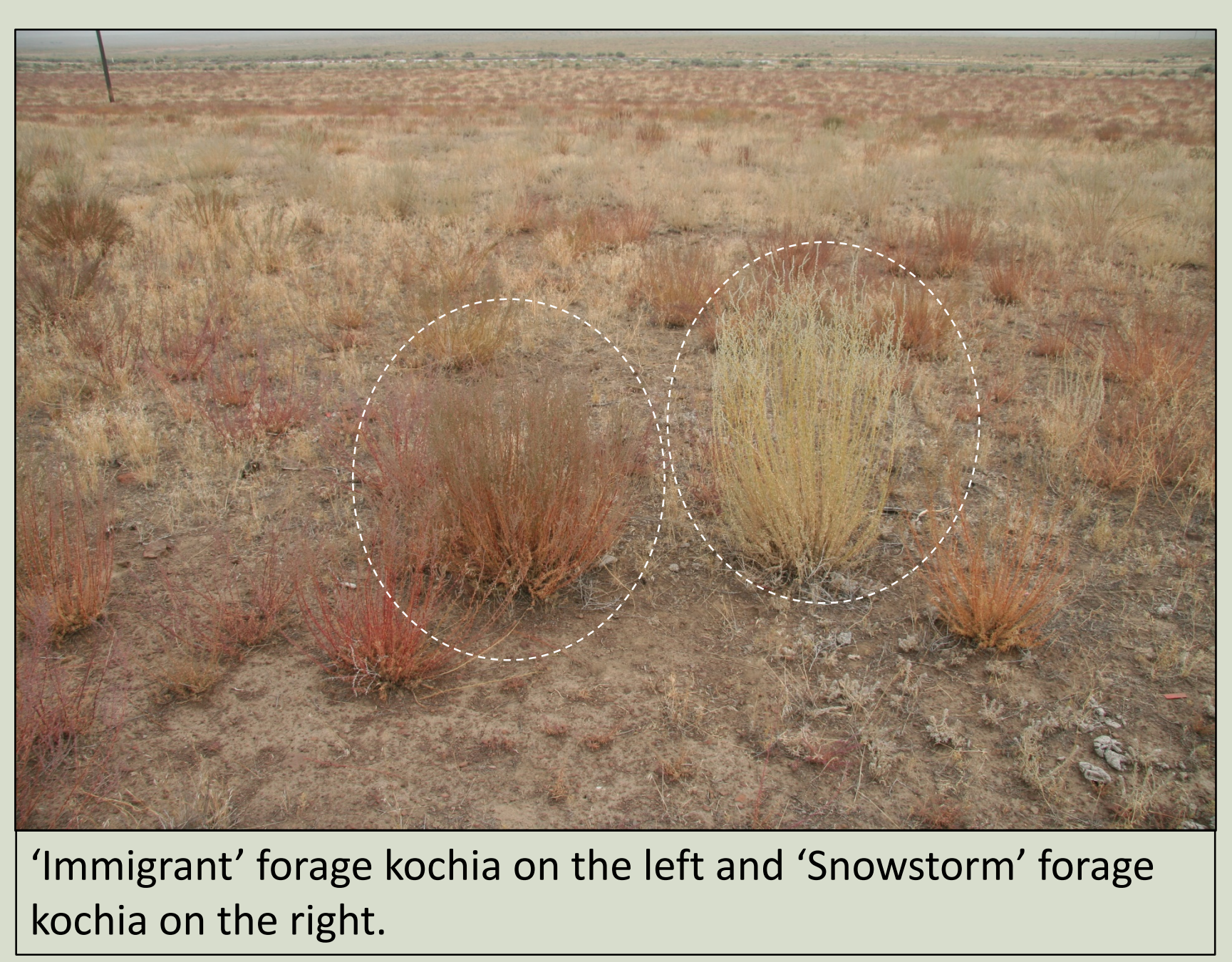
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Introduction

The cultivar 'Snowstorm' forage kochia (*Bassia prostrata grisea*) was released by the USDA-ARS in 2012. It is a synthetic cultivar selected for stature, forage production, and adaptation to semiarid environments. Similar to the earlier released (1984) 'Immigrant' (*Bassia prostrata*) cultivar, it can increase rangeland productivity magnitudes when used for rehabilitation.



'Immigrant' forage kochia on the left and 'Snowstorm' forage kochia on the right.

We conducted tests to observe the germination differences between the two cultivars for newly harvested, one year old and two year old seed with cold and non-cold storage. Non-cold storage consisted of a metal seed shed partially in the shade without any ventilation or cooling. The seed set time for forage kochia (Oct-Nov) makes using newly harvested seed difficult because of winter conditions soon after harvest time. Often one year old seed is the only option to use before winter conditions. One year old non-cold storage 'Immigrant' kochia seed has shown low seed viability, so seeding efforts often require cold storage seed and increased costs.



Plant material test, twenty meter drill rows of 50 different rangeland species. Only 'Snowstorm' forage kochia established out of the 50 species seeded. Species included 'Immigrant' forage kochia, crested wheatgrass, Siberian wheatgrass, and many native grasses and forbs.

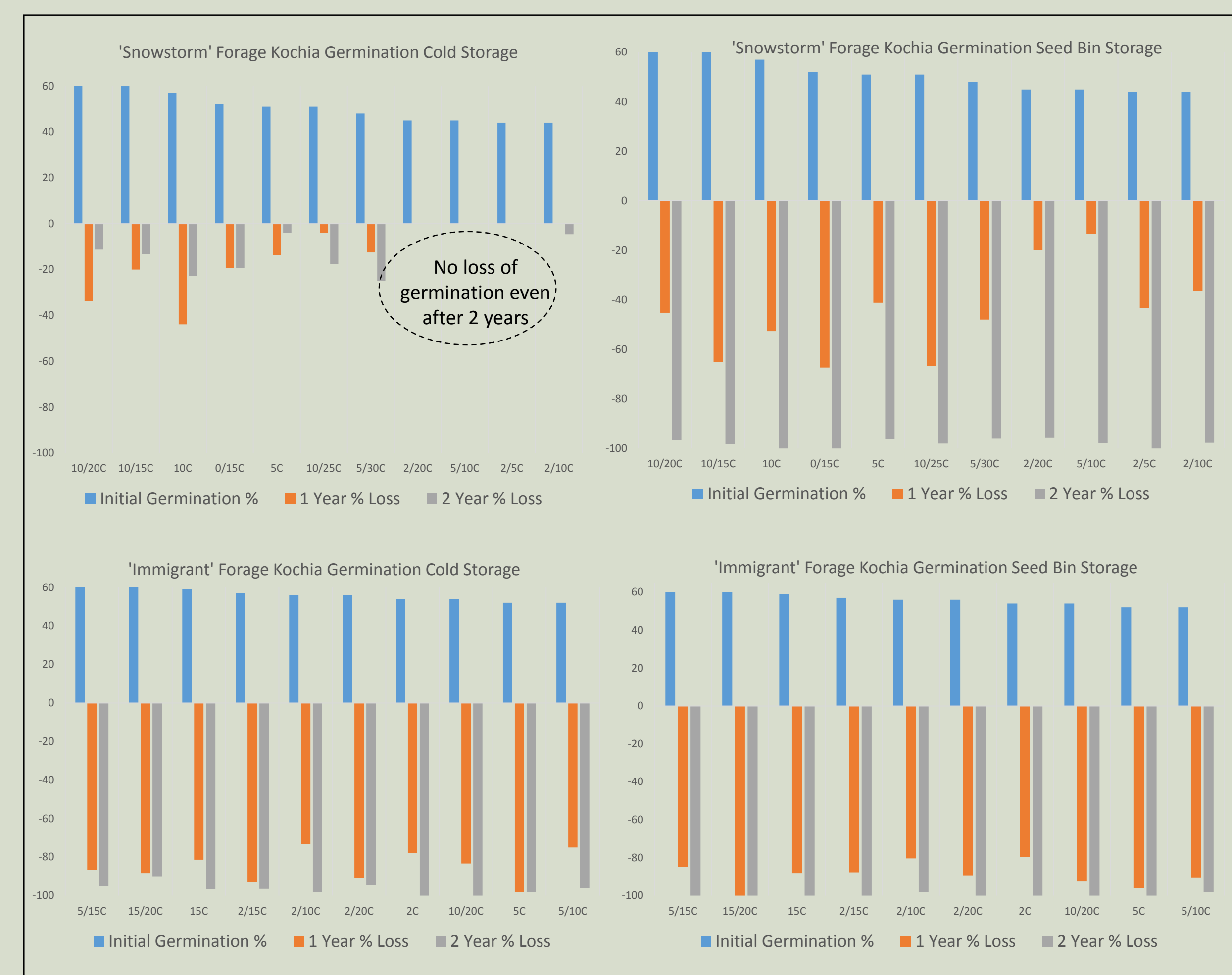


Figure 1. Fresh harvested kochia seed, ten top maximum germination temperatures and the percent loss of germination from maximum initial fresh harvested seed after one and two years of seed storage.



Five year old seeding of 'Snowstorm' forage kochia. Notice the seedlings filling in open niches so that cheatgrass can not invade those niches and build seedbanks as well as fuel (litter) that would increase fire risk. This "colonizing" seedling establishment leads to kochia being integrated into a plant community and positive effects like decreased fire risk and *strongly differs from Invasive behavior* in which a species invades and replaces desirable species and leads to damage of the ecosystem and a loss of function.



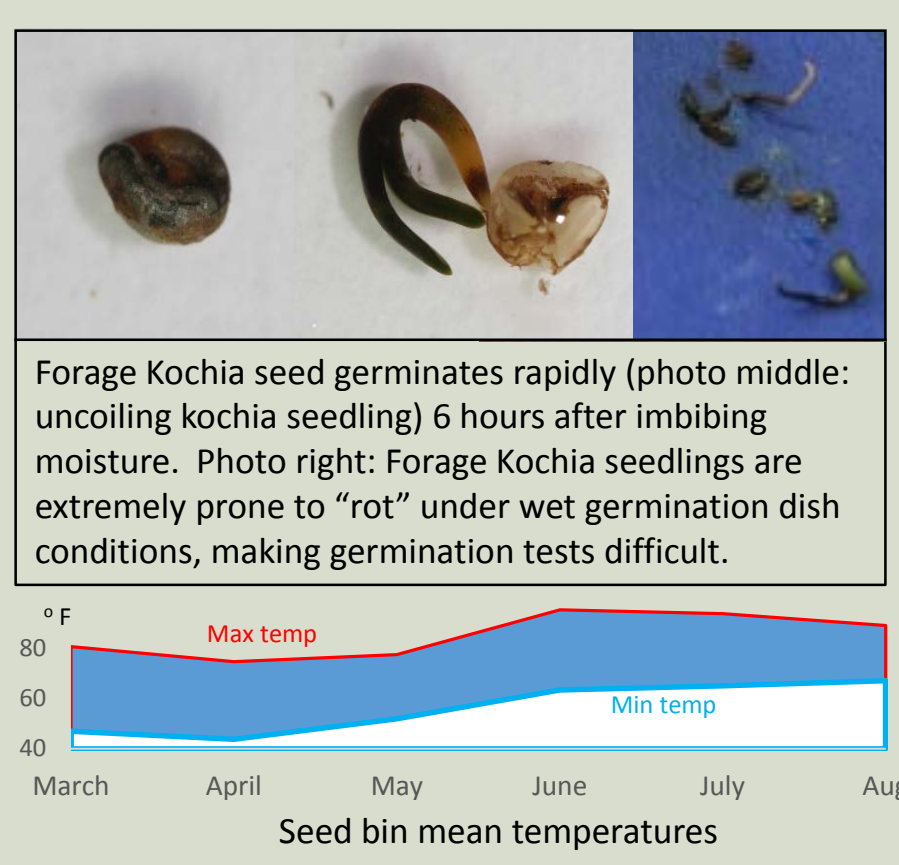
Figure 2. The negative of 'Snowstorm' having a higher duff to seed ratio (image left: duff waste) and lower seed production (image right: seed lot) is outweighed by the benefit of larger seeds (center: 'Snowstorm' top & 'Immigrant' bottom) and improved longevity and establishment.

Methods & Results

Using 55 different constant and alternating temperatures representative of Great Basin seedbed temperatures, we tested germination of the two cultivars for fresh, one and two year old seed from cold or non-cold storage. Cold storage was kept at a constant 7°C (44°F) seed bin storage followed seasonal temperatures with highs some times above 100°F.

Table 1: Percent germination for 55 temperature regimes. 1st number is 'Snowstorm' 2nd number is 'Immigrant'

Cold Period Temperature °C	Warm Period Temperature °C																			
	0	2	5	10	15	20	25	30	35	40										
0	36	3	37	39	43	18	43	35	52	48	30	47	41	40	21	38	0	5	0	5
2			33	54	44	45	44	56	31	57	45	56	43	47	28	46	31	19	9	29
5				51	52	45	52	37	60	34	49	40	47	48	44	22	9	24	21	
10					57	49	60	49	62	54	51	40	40	29	22	8	26	7		
15						34	59	41	60	32	46	23	43	22	33	31	18			
20								37	44	34	48	31	17	24	13	18	8			
25									27	11	23	11	14	11	8	8				
30											16	1	6	0	2	0				
35													1	0	0	0				
40															0	0				



Fresh seed had equal germination between cultivars ('Snowstorm' mean:30%, max:62%, 'Immigrant' mean:30%, max:60%)(Table 1). After two years of cold storage (7°C) 'Snowstorm' kochia remained viable with no germination loss and 44-45% germination at multiple germination temperatures (Figure 1). 'Immigrant' forage kochia had almost 100% germination loss with little viability left after two years regardless of storage conditions. We believe the larger seed size of "snowstorm" contributes to the improved seed longevity (Figure 2).

Post fire broadcast seeding of 'Snowstorm' forage kochia. Good establishment of kochia ensures decreased fire risk because of the higher moisture content of kochia plants during the dry summer months of the year.



This study supports observations of improvement for the cultivar 'Snowstorm' forage kochia and the need for greater seed supplies and increased rangeland rehabilitation use.