Beef production from native and seeded Northern Great Plains ranges

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Abstract

Multiparous crossbred cows (N=355) were studied over 4 years to evaluate effects of native range (NR) and seeded range on cow reproduction and performance during prebreeding from parturition to the start of breeding and during a 45-day breeding period. Treatments for prebreeding were: (1) NR and (2) crested wheatgrass (CW; *Agropyron desertorum* Fisch. ex [Link] Schult.) and during breeding: (1) NR, (2) Russian wildrye (RWR; *Psathrostachys juncea* [Fisch.] Nevski) and (3) contour furrowed NR (CF) interseeded with 'Ladak' alfalfa (*Medicago Sativa* L.). After breeding (postbreeding), all cows grazed NR to weaning in 3 of the 4 years. In year 4, calves were weaned at the end of breeding because of severe drought. Treatments and years were arranged as a factorial. Cow reproduction was evaluated by date of calving, the number of cows in estrus at least once before the beginning of breeding, and fall pregnancy rate. Prebreeding, breeding, and year effects as well as all interactions were nonsignificant (P>0.05) for all reproductive traits. Milk production and milk composition were not affected by prebreeding or breeding treatments. Differences in cow and calf weight gains occurred between prebreeding treatments and generally favored CW. Small differences also occurred in cow weight gains between breeding treatments. All cows gained weight and body condition during prebreeding and breeding and then lost weight and condition postbreeding. Breeding treatment effects on calf gains were small. We concluded that the primary benefits of seeded ranges in the Northern Great Plains are comparable to those documented for increased stocking rate and improved forage management. Seeded ranges did not improve individual animal performance.

Key Words: reproduction, crested wheatgrass, Russian wildrye grass, contour furrows, milk production, body condition

Spring calving is the norm for Northern Great Plains beef cow operations. If a cow calves before plant growth begins, loss of body weight and condition is expected. Introduced cool-season grasses may improve cow performance. Crested wheatgrass (*Agropyron desertorum,* Fisch. ex [Link] Schult.) is ready for spring grazing from 10 days to 5 weeks earlier than native species and when grazed following spring calving has improved pregnancy rates over cows grazing native range (Houston and Urick 1972). However, the beneficial effect of crested wheatgrass on pregnancy rate has not always occurred (Hart et al. 1983).

Russian wildrye (*Psathrostachys juncea* [Fisch.] Nevski) is noted for its high forage quality during the summer and fall (Wight et al. 1983). Contour furrowing is a range renovation practice that increases water infiltration of soils (Neff 1973) and forage production (Kartchner et al. 1983). Russian wildrye and contour furrowed native range have potential for improving cow reproduction if grazed during the breeding period.

Our objectives were to determine the effects of grazing seeded and native rangeland during prebreeding (calving to the beginning of the breeding) and breeding periods on cow reproduction and performance. The hypothesis was that cow reproduction and performance would be enhanced by use of seeded rangeland during the prebreeding and breeding periods.

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Study Site and Methods

Study Site

In 1977, 79 and 68 ha of native rangeland (NR) were plowed and seeded to crested wheatgrass (CW) and Russian wildrye (RWR) respectively, using procedures recommended for the Northern Great Plains (White and Lacey 1985). In addition, 80 ha of NR were contour furrowed (CF) with a lister type plow and seeded with 'Ladak' alfalfa (*Medicago sativa* L.) as described by Kartchner et al. (1983). Two pastures of NR (265 and 194 ha) in good to excellent condition were also used in the study. All rangeland was in a continuous block with a centrally located cattle-working facility.

The soils in the improved pastures were deep, well-drained, Borollic camborthids and Pinelli loams from the Kobar and Pinelli series. Soils on the native range site were Delpoint, Gerdrum, Kobar, and Creed series. The Delpoint complex includes shallow soils located on moderate to steep slopes (8–75%) and ridge tops. The Gerdrum, Kobar, and Creed complex's include deep, well-drained soils occurring on moderate slopes (2–8%), footslopes, fans, and terraces.

Major forage species in the NR and CF pastures were western wheatgrass (*Pascopyrum smithii* [Rydb.] Love), blue grama (*Bouteloua gracilis* [H.B.K.] Lag. ex Griffiths), needle-and-thread grass (*Stipa comata* Trin. and Rupr.) buffalo grass (*Buchloe dactyloides* [Nutt.] Engelm.), green needlegrass (*Stipa viridula* Trin.), cheatgrass (*Bromus tectorum* L.), Japanese brome (*Bromus japonicus* Thunb.), and threadleaf sedge (*Carex filifolia* Nutt.). Other important plants include silver sagebrush (*Artemisia cana* Pursh), fringe sagewort (*Artemisa frigida* Willd.), greasewood (*Sarcobatus vermiculatus* [Hook.] Emory.), and plains pricklypear (*Opunta polycantha* Haw.).

Cattle Management

A total of 355 multiparous crossbred beef cow-calf pairs were assigned to 2 prebreeding and 3 breeding season forage treatments from 1982 to 1985 (Table 1). Prebreeding treatments were: (1) NR; and (2) CW. Breeding treatments were: (1) NR; (2) RWR; and (3) CF. Cows were wintered on NR and average calving date was 9 April. Following calving, cows grazed NR and were given prairie hay free choice until the prebreeding treatments began. Cows began grazing the prebreeding forage when new growth of CW attained a height of approximately 13 cm as recommended by Currie and Smith (1970). Cows which had calved, began grazing prebreeding forages on 26 Apr. 1982; 17 Apr. 1983; 23 Apr. 1984 and 1 May 1985. Cows which had not calved by the initial stocking date for the prebreeding were moved to prebreeding pastures at about 7-day intervals following calving. Prebreeding treatments

Table 1. Number of cows assigned to prebreeding and breeding treatments 1982 to 1985.

Year	Treatment[a] Prebreeding NR	CW	Breeding NR	RWR	CF	Total
1982	49	48	33	31	33	97
1983	58	56	37	38	39	114
1984	37	40	28	23	26	77
1985	35	32	22	22	23	67
Total	179	176	120	114	121	355

[a]NR = native range, CW = crested wheatgrass, RWR = russian wildrye and CF = contour furrowed native range.

ended and breeding treatments began 26 May each year. Grazing on the breeding forage treatments extended from 26 May to 29 July except in 1985 it ended on 2 July. Following the breeding period (postbreeding) all cows grazed NR as one group until calves were weaned. Calves were weaned when forage utilization approached 50%. Weaning dates for 1982, 1983, and 1984 were 12 Oct., 18 Sep., and 17 Sep., respectively. Weaning dates in 1983 and 1984 were earlier than 1982 because of drought conditions. In 1985 a severe drought made it necessary to wean calves at the end of the breeding season (2 July).

Cows and calves were weighed, and cows were condition scored at the beginning of each prebreeding and breeding period, at the end of the breeding period, and at weaning. Body condition scores were based on a palpated determination of fleshing over the ribs and thoracic vertebrate (Bellows et al. 1971). Condition scores were the average of independent estimates by 2 technicians. The possible range for numerical scores was from 1 (thinnest) to 10 (fattest).

Sterile bulls fitted with grease marking harnesses were used to detect estrus. They were placed with the cows on 29 May during 1982, 1983, and 1984, and on 23 May on 1985. All cows were checked daily for estrus. The sterile bulls were removed on 12 June 1982–1984 and 28 May 1985, and the ovaries of cows that had not been detected in standing estrus were palpated for a corpus luteum. A palpable corpus luteum was considered evidence that a cow had been in estrus at least once.

A 2-yr-old and a yearling bull were placed in breeding pastures on 15 June and removed 45 days later (29 July 1982–1984). Two bulls were placed in breeding pastures on 29 May 1985, but they were removed 35 days later on 2 July. Calving dates were recorded for cows bred in 1982–1984. During 1985 breeding bulls were fitted with a grease marking harness and cows were checked daily for estrus and dates recorded. During 1982–1984, cows were pregnancy tested by rectal palpation at weaning, and on 23 Aug. 1985.

Milk Production

Twelve-hour milk production estimates for each cow were determined 3 times annually from 1982–1984 by the calf weigh-suckle-weigh (WSW) technique. These determinations were made several days before the start of the breeding period, at the end of the breeding period, and several days before weaning. On the day preceding each WSW, cows and calves were gathered from pastures at about 1300 hours and calves were sorted from the cows into pens of 6 to 8 calves. Later that day at 1800 hours, calves were allowed to suckle cows and were again sorted from the cows. Twelve hours later at 0600 hours each calf was weighed, allowed to suckle the cow and reweighed. The difference in calf weight before and after suckling was considered the 12-hour milk production of the cow. Two days following the WSW at the beginning and end of the breeding period, 12 cows and calves from each breeding treatment (6 from each prebreeding treatment) were gathered, sorted, and suckled as described for the WSW. However at 0600 hours, cows were restrained in a chute, given an intramuscular injection of oxytocin for milk let down, and the right front quarter of each cow was milked dry. This milk was mixed, subsampled and sent to the Dairy Herd Improvement Laboratory (DHIA) at Logan, Utah for determination of protein and fat content.

Analysis Procedures

At weaning, all nonpregnant cows were removed from the study. Each spring, cows were added as needed. Cows were randomly assigned to treatments each spring before calving. Data for 1982 to 1984 were analyzed as a $2\times3\times3\times2$ factorial. Main effects were 2 prebreeding treatments, 3 breeding treatments, 3 years, and sex of calf. Data for 1985 were analyzed with the same model except it did not include a year effect. All 2-way interactions were tested. Three- and 4-way interactions were considered part of the error mean squares. Date of calving was analyzed as a dependent variable and for other traits it was included in the model as a covariate. Data were analyzed by least squares analysis of variance procedures (Harvey 1979). Cows were considered experimental units and a random effect. The findings of Conniffee (1976a, 1976b) were the rationale for experimental units. Treatments, year, and calf sex were considered fixed effects. The breeding treatment means were compared by preplanned orthogonal contrasts (NR vs. other and CF vs. RWR). All differences mentioned in this paper are significant at the $P<0.05$ probability level.

Results and Discussion

Annual precipitation was 118, 63, 63, and 91% of the long-term average for 1982, 1983, 1984, and 1985, respectively (Table 2).

Table 2. Monthly and annual precipitation (cm) for 1982 through 1985.

Year	April	May	June	July	August	Total[a]	Total for year
Long term average	3.5	5.9	7.0	3.9	3.2	23.5	35.5
1982	1.4	6.6	13.0	1.8	1.6	24.4	41.8
1983	<.1	3.5	6.2	4.8	.8	15.3	22.3
1984	3.4	2.3	9.0	.5	2.3	17.5	22.3
1985	2.2	3.0	2.8	8.0	4.7	20.7	32.4

[a]Total for April through August.

Precipitation from April through August was 104, 65, 74, and 88% of the long-term average respectively.

All main effects, interactions and the covariate (calving date) for cows in estrus before the beginning of the breeding season, fall pregnancy rate, date of calving (1982–1984) and breeding date (1985) were nonsignificant (Table 3). Pregnancy rate of the cows was over 90% during the study, even in 1985 when the breeding season began 18 days earlier than planned and was only 35 days in

Table 3. Reproductive performance of cows grazing native or seeded range.

Trait	Mean[a] 1982–84	1985	Error mean squares 1982–84	1985
Cows in estrus before the beginning of the breeding period, %	85.6	61.7	1403	2379
Fall pregnancy rate, %	92.4	91.2	660	919
Date of calving	105		486	
Breeding date		164		196

[a]All main effects, interactions, and the covariate date of calving were nonsignificant, $P > 0.05$.

Table 4. Changes in body weight and condition score for cows grazing native range (NR) crested wheatgrass (CW), russian wildrye (RWR), and contour furrowed (CF) native range during the prebreeding (PreB), breeding (B), and postbreeding (PostB) periods of 1982 through 1984.

	Prebreeding treatment		Breeding treatment			Year			
Period[a]	NR	CW	NR	RWR	CF	1982	1983	1984	EMS[b]
	Body Weight Change, kg								
PreB	15.7[c,d]	24.7				30.9[e]	16.3	13.4	344
PreB + B	62.7[c]	70.4				73.6[e]	47.3	78.8	620
PreB + B + PostB	38.0[c]	44.7				53.8[e]	19.6	50.7	617
B	47.0	45.7	43.8[f]	45.4	49.8	42.6[e]	30.9	65.5	387
B + PostB	22.7	20.0	15.3[f]	22.2	26.0	22.9	3.3	37.3	313
PostB	–24.7	–25.7	–28.6	–23.3	–23.8	–19.8[e]	–27.7	–28.1	396
	Body Condition Change								
PreB	.3[c]	.6				.5	.5	.5	.42
PreB + B	1.2[c]	1.3				2.1[e]	1.0	.5	.42
PreB + B + PostB	.8[c]	1.0				1.6[e]	.5	.6	.49
B	.8[c]	.7	.7[g]	.7	.9	1.6[e]	.5	.1	.38
B + PostB	.5	.3	.2[f]	.5	.6	1.1[e]	0.0	.1	.46
PostB	–.3	–.3	–.5[g]	–.2	–.3	–.5[e]	–.5	.1	.33

[a]Body weight (kg) and body condition score (1–10) were 465 and 4.5 respectively at the beginning of the prebreeding period and were both similar ($P>0.05$) for all treatments.
[b]EMS = error mean squares.
[c]NR vs. CW significant ($P<0.05$).
[d]Prebreeding treatment × year interaction significant ($P<0.05$), see text for means.
[e]Year effect significant ($P<0.05$).
[f]NR vs. RWR + CF significant ($P<0.05$).
[g]Breeding treatment × year interaction significant ($P<0.05$), see text for means.

length. In Wyoming, Hart et al. (1983) made comparisons of CW in combination with NR, and NR only during the spring-summer. In agreement with our findings, they found similar pregnancy rates between the CW and NR treatments. In contrast, Houston and Urick (1972) at Miles City reported higher fall pregnancy rate for cows that grazed CW during the spring than those that grazed NR. An explanation for this difference in pregnancy rate between our study and that of Houston and Urick (1972) may be related to range condition. The latter authors reported NR in their study was mostly in fair condition compared to the good to excellent NR in the present study. As condition increases on the Northern Great Plains ranges, the proportion of cool-season grasses increases (Turnbull et al. 1977). Therefore, we hypothesize that diet quality during the early spring was greater in this study than in the study of Houston and Urick (1972), because of the availability of greater amounts of cool-season grasses.

Cow Body Weight and Condition

Year effects were observed for all cow body weight and most condition score changes during the study (Tables 4 and 5). Condition score changes during prebreeding were not affected by year. Cows gained weight and condition during the prebreeding and breeding periods each year. However, cows generally lost weight and body condition postbreeding. Weight and condition gains during prebreeding were greater for cows grazing CW than NR and this difference persisted through weaning. The effects of CW and NR on prebreeding weight gains, however, were not consistent across years as demonstrated by the prebreeding treatment × year interaction. All other weight and condition score interactions for the prebreeding period were nonsignificant. Cow weight gains for NR and CW during prebreeding 1982, 1983, and 1984, were: 21.2, 40.7; 13.3, 19.3; and 12.9, 13.9 kg, respectively. Weight gains were greater from CW than from NR during 1982 and 1983 but were similar for 1984. We interpreted the prebreeding treatment × year interaction to show that differences in cow gains between CW and NR were greatest when precipitation was most favorable. For 1985, cow weight gains during prebreeding were similar for CW and NR, but CW cows gained 0.4 more condition score than cows grazing NR. During the drier years, weight gains from CW and NR were similar to those reported by Hart et al. (1983). When precipitation was above average, weight gains were more similar to those reported by Houston and Urick (1972).

Table 5. Changes in body weight and condition score for cows grazing native range (NR), crested wheatgrass (CW), russian wildrye (RWR), and contour furrowed (CF) native range during the prebreeding (PreB) and breeding (B) periods during 1985.

	Prebreeding Treatment[b]		
Period[a]	NR	CW	EMS[c]
	Body Weight Change, kg		
PreB	40.6	45.6	268
PreB + B	59.0	60.5	254
B	16.4	14.8	206
	Condition Score Changes		
PreB	.3[d]	.7	.18
PreB + B	.4[d]	.8	.34
B	.2	.1	.30

[a]Body weight (kg) and body condition score (1–10) were 508 and 5.0 respectively at the beginning of the prebreeding period and were both similar ($P>0.05$) for all treatments.
[b]All breeding treatment effects, interactions and the covariate were nonsignificant, $P > 0.05$.
[c]EMS = Error mean squares.
[d]NR vs CW significant $P<0.05$.

For 1982–1984, cow weight gains during the breeding period were relatively small but significantly greater for the average of RWR and CF than NR treatment, and this difference persisted until weaning. Cow weight gains during the breeding period for 1985 were similar for all breeding treatments, and no interactions were detected. Prebreeding treatments and calving date did not affect cow weight gains during breeding periods for 1982–1984 or 1985. Kartchner et al. (1983) reported that weight gains of steers grazing NR were greater than those grazing CF. Smoliak and Slen (1974) reported similar summer gains for yearling cattle grazing either RWR or NR. In our study, cows from each treatment lost body weight postbreeding, but these losses were not influenced by prebreeding or breeding treatments. The observed postbreeding weight losses are attributed to low dietary protein expected at this time of year (Adams et al. 1987, Adams and Short 1988).

During 1985, gains in body condition score during the breeding period were similar for all prebreeding and breeding treatments and no interactions were detected during this period. Effects of the

Table 6. Milk production and protein and fat content of milk from cows grazing native and seeded range 1982 to 1984.

Item	Mean[a]	Year 1982	1983	1984	EMS[b]
		Beginning of Breeding (June 14)			
12-h milk production, kg	4.32	4.77[c]	4.28	3.90	2.05
Protein, %	3.18	3.14	3.16	3.23	.319
Fat,%	3.50	3.35[c]	2.80	4.35	1.46
		End of Breeding (August 1)			
12-h milk production, kg	3.33	3.68[c]	2.84	3.46	1.20
Protein, %	3.12	3.18	3.09	3.09	.042
Fat, %	3.32	3.49	2.99	3.46	.644
		Weaning (September)			
12-h milk production, kg	2.17	2.04[c]	1.77	2.71	1.30

[a]All treatment effects and interactions were nonsignificant ($P>0.05$) except for the breeding treatment × year interaction for end of breeding protein which was significant ($P<0.05$), see text for interaction means.
[b]EMS = Error mean squares.
[c]Year effects were significant ($P<0.05$).

prebreeding treatments on changes in body condition score from the beginning of the breeding season until weaning, and during postbreeding were nonsignificant for 1982–1984. Interactions for these periods were also nonsignificant. Body condition score gains during breeding periods of 1982–1984 were similar for the 3 breeding treatments, but a breeding treatment × year interaction occurred. The within-year breeding treatment contrasts for body condition scored gains during the breeding period revealed that all contrasts except the RWR vs. CF contrast for 1982 were nonsignificant. Breeding treatment means for body condition gains during 1982 were 1.7, 1.3, and 1.9 for NR, RWR, and CF, respectively. From the beginning of the breeding period to weaning, body condition score change was less for cows grazing NR than for the average of those grazing RWR and CF. All interactions were nonsignificant.

During postbreeding, cows from each breeding treatment lost body condition and the breeding treatment × year interaction was significant. Treatment differences for body condition changes during postbreeding were significant only for 1982. During 1982, the change in body condition was -.9, 0.0 and -.6 for NR, RWR and CF, respectively; the NR vs. RWR + CF and RWR vs. CF contrasts were significant. Although some prebreeding and breeding treatment effects on body weight and condition score changes occurred, these effects were too small to affect reproduction traits measured.

Milk Production

Twelve-hour milk production was similar for all prebreeding and breeding treatments at each sample date and all interactions were nonsignificant (Table 6). Year effects were noted for milk production at each sample date. The covariate (calving date) affected milk production at the end of the breeding period, i.e., cows that calved earlier gave less milk than those calving later. Fat content of the milk was similar for all prebreeding and breeding treatments. Fat content of the milk at the beginning of the breeding period was affected by year and at the end of the breeding period by date of calving. No interactions were detected for milk fat. Date of calving did not affect protein content of the milk. Milk protein content at the beginning of breeding was similar for all prebreeding and breeding treatments and no interactions were observed. Milk protein at the end of the breeding period was greater for cows which grazed NR during the prebreeding period than for those that grazed CW. Milk protein at the end of the breeding period was not affected by year or calving date. However, the breeding treatment by year interaction was significant. Protein content (%) of the milk for NR, RWR, and CF at the end of the breeding period 1982, 1983, and 1984 was 3.15, 3.06, 3.34; 3.21, 3.06, 3.02; and 3.07, 3.20, 3.00, respectively. Milk protein was similar during each year for NR and for the average of the RWR and CF treatments. During 1982, milk protein of the cows was greater for CF than RWR and, in 1984, it was greater for RWR than CF. Milk protein of the cows was similar for CF and RWR treatments during 1983. Thus, milk protein was greater for cows on CF than RWR during the wet year but was greater for RWR than the CF treatment during a drought year.

Calf Weight Gains

At the beginning of the prebreeding period, calves weighed an average of 53.3 kg and 64.0 kg during 1982–1984 (Table 7) and 1985, respectively. Calf weights at the beginning of the prebreeding period were similar for all treatment groups. The covariate calf birth date was significant for each weight gain tested, thus all calves were adjusted to a common birth date. Body weight gains were greater during each year for male than female calves and all sex of calf interactions were nonsignificant. Calf gains during 1985 were not affected by any of the prebreeding or breeding treatments, and all interactions were nonsignificant. During 1982–1984, calves gained a total of 68.7 kg from the beginning of the prebreeding period on 21 Apr. through the end of the breeding period on 2 July. by year reflecting differences in dates for the beginning of the prebreeding period and weaning. Calf weight gains during the prebreeding period were greater for calves grazing CW than for those on NR. Although small, this weight difference was evident at the end of the breeding period and at weaning. In 1985, calves gained a total of 68.7 kg from the beginning of the prebreeding period on 21 Apr. through the end of the breeding period of 2 July.

Table 7. Weight gains (kg) of calves grazing native range (NR), crested wheatgrass (CW), russian wildrye, and contour furrowed native range during the prebreeding (PreB), breeding (B), and postbreeding (PostB) periods during 1982 through 1984 and 1985.

Period[a]	Prebreeding treatment[b] NR	CW	Year[c] 1982	1983	1984	EMS[d]
			1982–1984			
PreB	32.9[e]	35.2	31.3	37.9	32.9	68.9
PreB + B	101.1[e]	102.7	105.5	108.9	89.8	171
PreB + B + PostB	151.6[e]	155.6	169.3	151.1	140.5	318
B	67.2	67.5	74.2	70.9	56.9	74.8
B + PostB	118.7	120.4	138	113	108	182
Post B	51.1	52.6	63.4	41.7	50.3	76.2
			1985			
PreB	26.0	27.2				22.5
PreB + B	68.3	72.0				67.6
B	39.0	39.0				30.5

[a]Body weight (kg) at the beginning of the prebreeding period was 53.3 and 64.0 for 1982–1984 and 1985 respectively and were similar ($P>0.05$) for all treatments.
[b]All breeding treatment effects and interactions were nonsignificant $P>0.05$, except the prebreeding treatment × breeding treatment interaction for 1982–84 which was significant, see text for interaction means.
[c]All year effects and covariate (date of birth) were significant $P<0.05$.
[d]EMS = Error mean squares.
[e]NR vs CW significant $P<0.05$.

The prebreeding treatment × year interaction was significant for calf weight gains during the breeding period. Calf gains (kg) for the prebreeding treatments NR and CW during the breeding period, 1982, 1983, and 1984 were 73.8, 74.5; 72.8, 69.1; and 54.9, 58.8, respectively. Differences in weight gains between calves from the 2 prebreeding treatments during the breeding period were observed during 1983 and 1984 but not 1982. An explanation for this finding is not apparent because during the wet year calf gains were similar for NR and CW, but during the 2 dry years gains were greater for

CW in one year and greater for NR in the other. Calf weight gains during the post breeding period were similar for all prebreeding and breeding treatments and all interactions were nonsignificant.

Conclusions

Calving date, occurrence of initial estrus, and fall pregnancy rate of beef cows were not affected by the use of seeded pastures during prebreeding or breeding periods. Some advantages in cow and calf performance occurred between treatments, but these effects were generally small. We concluded that native range in the Northern Great Plains that has not been abused through overstocking or other forms of mismanagement are capable of producing forage which is difficult to improve on for individual animal performance. The benefits from using seeded pastures over NR were comparable to those documented from the deferment of spring grazing on NR. They mainly contribute to an increased stocking rate and improved forage management. They did not significantly improve the reproductive efficiency of beef cattle.

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