Suggestions for Mechanization of Harvesting Cactus for Cattle Feed

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There have been other papers in the Proceedings of the Texas Prickly Pear Council describing use of cactus as cattle feed (Johnson, 1994; Jesus-Fuentes, 1992; Maltsberger, 1991; Hanselka and Falconer, 1993; Hamilton, 1992). It appears that the nutritional aspects of cactus as cattle feed are moderately well understood (Maltsberger, 1991). At this time, the difficulties in use of cactus as cattle feed seem to be due to the level of efficiency of harvesting of cactus.

Rising costs of labor and the difficulty in hiring experienced laborers willing to operate a propane torch to burn spines off cactus in the summer, prompted a session on ways to mechanize the harvesting and preparation of cactus as cattle feed.

There are two fundamentally different approaches to mechanizing the harvesting of cactus for cattle feed. The first approach is to increase the efficiency with which cactus can be harvested in existing pastures. The second approach involves use of equipment to harvest cactus that has been planted in rows.

Gene Walker has pioneered the use of propane torch attachments on tractors used in existing pastures. A video of one of these systems was presented at the meeting. In this procedure, a series of propane burners are mounted behind a standard farm tractor that drives over cactus in an unplanted pasture and burns the spines from the cactus. This operation has the very significant advantage of having no cost involved in establishing the cactus. The disadvantage is that there may not be sufficient tonnage for the cattle.

Gonzalez (1989) has demonstrated the production of 15 tons dry weight per acre per year of 10% protein cactus from genetically unimproved native spiny cactus with fertilization. Thus, it is clear that the production of unimproved cactus types is sufficient to warrant planting it in rows for cattle feed. Establishing plots with hundreds of tons of cactus per acre would be critical in using an agricultural forage harvester especially suited to harvesting about 30–50 tons of forage per hour.

If a machine were developed that could harvest cactus for the same cost as corn or sweet-sorghum silage, the economics of growing cactus for cattle feed could be very favorable. Since the cost of harvesting normal silage is only about $1 per ton (Cullen and Barr, 1981) and since

Maltsberger (1991) has suggested that 100 lb of cactus are required per animal per day, the cactus harvesting cost per animal would be only $0.05 per day. Furthermore, at a harvesting rate of 40 tons/hour, and a standing cactus fresh weight of 100 tons per acre, it would be necessary to operate for only 1 hr on 0.4 acre to obtain 100 lb of cactus per head for a herd of 800 cattle.

A U.S. Department of Energy report (Cullen and Barr, 1981) indicated that agricultural forage choppers can harvest and chop forage for $0.94 per green ton while the chipping costs alone of large diameter trees with a Morbark 22 chipper is $3.85 per green ton. Thus it should be possible to harvest and chop cactus silage for a similar cost. Fortunately, some components of the chopping of cactus for silage are well known and in routine use. After cactus has been severed at ground level by hand, there is no problem in chopping it and blowing it into a wagon with power takeoff (PTO) driven forage choppers (Fuentes-Rodriguez, 1992; Johnson, 1994; Maltsberger, personal communication). In Mexican feedlot operations there have been no adverse affects from feeding chopped cactus to cattle without first burning off the spines (Johnson, 1994).

The principal problem seems to be properly severing the cactus plant and transporting it to a chopping device. Cactus cladodes can be cut easily with a machete or sharp knife. Nevertheless, the massive weight of cactus plants (220 lb for a 4 ft tall and wide plant) might overwhelm typical agricultural cutters due to the mass not hardness. Custom hay harvesters in Texas report that they routinely sever 2 ft tall cactus plants with a rotary disk mower, such as a John Deere Model 240, (Figure 1) at speeds of 6 mph. Nevertheless, these mower/conditioners are not designed for the massive weight of cactus and may not hold up in routine use.

For these reasons, it seems reasonable to investigate use of industrial equipment used to move massive quantities of soil and industrial sludge. Stan Brown is the President of Brown Bear Corp., which designs and manufactures such equipment. One example of a possible configuration is shown in Figure 2. Here a heavy-duty augur is used to windrow soil to one side of the machine. Because the augurs are capable of windrowing soil, it is believed that they would be strong enough to sever and windrow the cactus. A second pickup device elevates and transports the soil to the rear. Substitution of a smooth augur surface with a serrated paddle assembly (Figure 3) might be more efficient in severing and windrowing the cactus.

A second alternative configuration would be the use of front mounted snow blowers as shown in Figure 4. It is envisioned that a serrated-tooth augur would be mounted in front of the snow blowers to sever the cactus and deliver it to the blower assembly of the snow blower. In this application, the augur would move the cactus to the center of the row instead of delivering it to the side of the tractor.

While the capital cost of acquiring a $95,000 silage harvester is beyond the capabilities of many ranchers, Darwin Baucum, President and General Manager of the Robstown, Texas, John Deere dealership, would consider the possibility of leasing such equipment to bona fide ranchers who wish to feed cactus to cattle.

At this time it appears necessary to test the components of potential severing, chopping, and blowing equipment. Fortunately, small self-powered attachments are available for testing (Figure 5). Stan Brown is willing to provide one of these smaller units for testing and demonstration if the freight for transport to Texas can be arranged.

At this time it appears as if a small working group of ranchers, agricultural equipment dealers and equipment manufacturers are needed to jointly work out the harvesting, production, and

leasing of equipment to take advantage of the excellent production and feed value possible from native cactus. A national program is underway in Mexico to improve utilization of cactus for cattle feed (Fuentes-Rodriguez, personal communication). It would be most beneficial if a binational working group were established to tackle this important problem for arid lands.

Given the proven production of 15 tons dry weight per acre per year of 10% protein cactus with fertilization but no irrigation, there is a significant opportunity to greatly improve the economics of cattle feed in Texas. The only limitation to realizing this opportunity lies in the mechanization of harvesting and delivery of this resource. It is hoped that a small working group will materialize to capitalize on this important opportunity.

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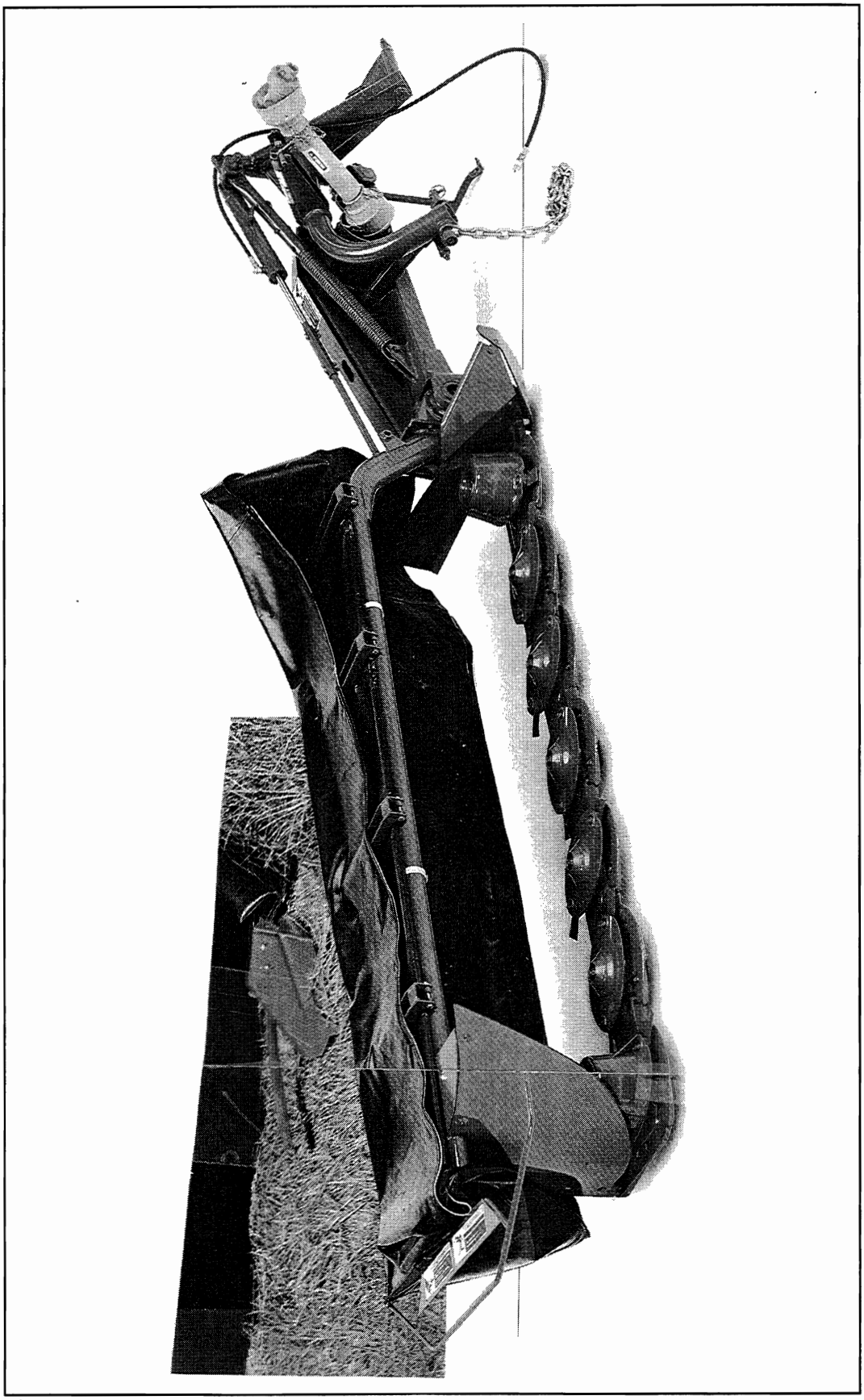

Figure 1

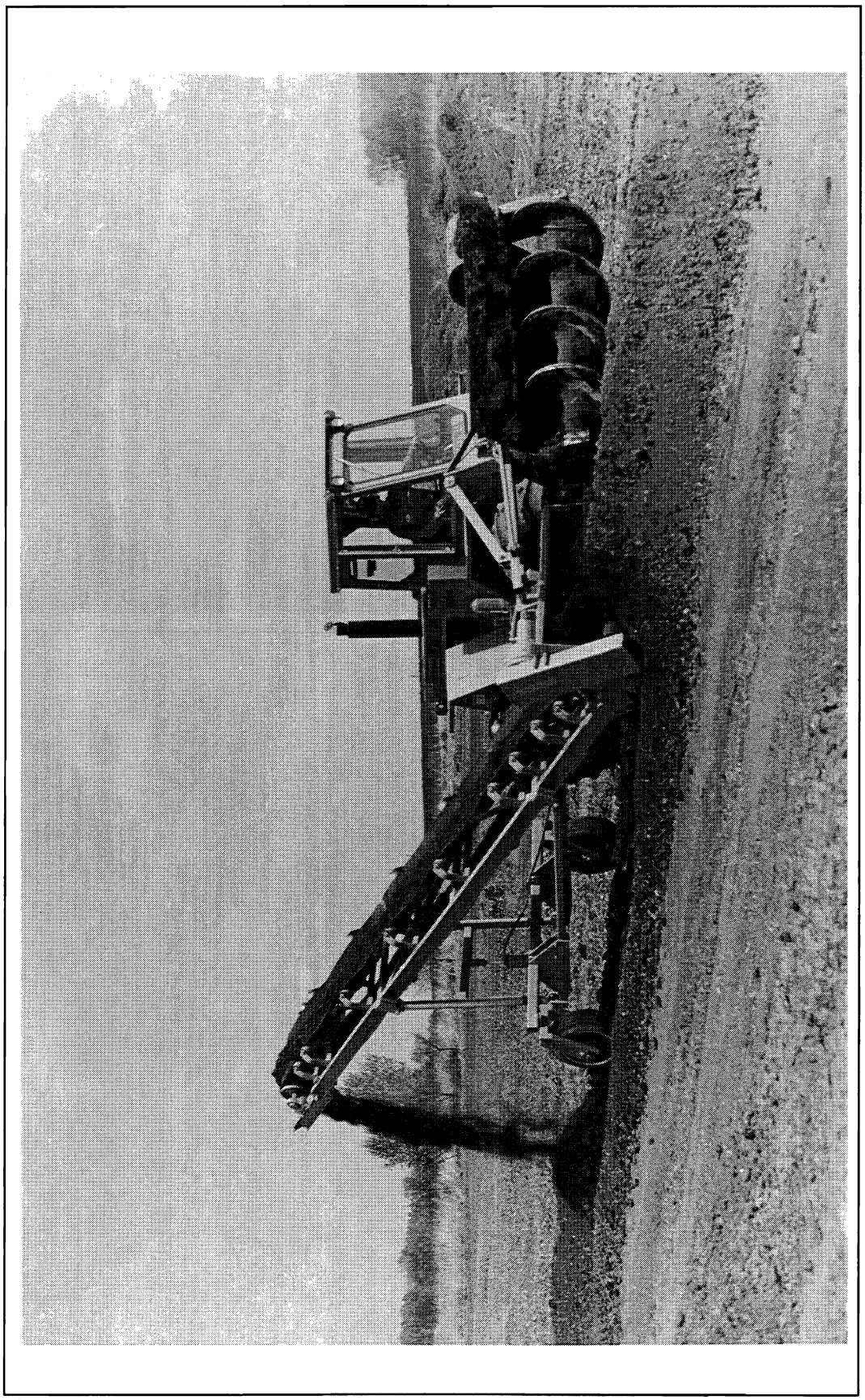

Figure 2

Figure 3

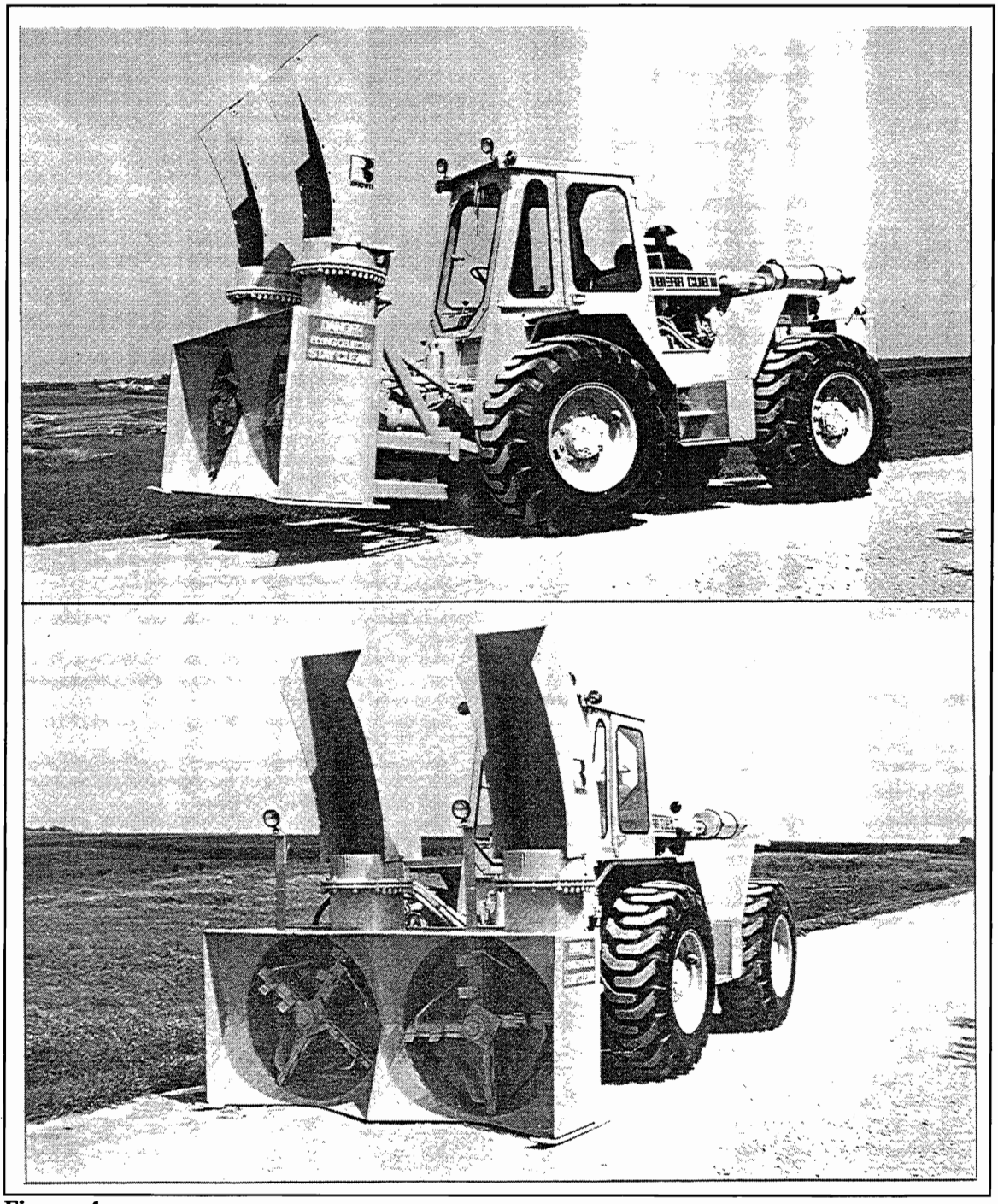

Figure 4

Figure 5