College of Agricultural, Consumer and Environmental Sciences

BE BOLD. Shape the Future.
New Mexico State University
aces.nmsu.edu

Jujube Basics and Cultivar Performance in New Mexico

Shengrui Yao
Fruit Specialist
NMSU Alcalde Center
505-852-4241
yaos@nmsu.edu

The College of Agricultural, Consumer and Environmental Sciences is an engine for economic and community development in New Mexico, improving the lives of New Mexicans through academic, research, and Extension programs.

1

Jujube- Chinese date

- **Family**: Rhamnaceae (buckthorn family)
- **Genus**: Ziziphus
- **Species**: *Ziziphus jujuba* Mill. (China 800/US 100?)
- **Wild jujube**: *Ziziphus spinosa*
- **Indian jujube**: *Ziziphus mauritiana*
- Edible part: drupe fruit, pit with up to 2 seeds inside

2

Classification

Same species with varied tree forms, fruit size and shapes, and maturity date. Cultivars are all by selections. Almost no hybrid cultivar yet.

By uses:

- Fresh eating
- Drying
- Multipurpose (Both fresh eating and drying)
- Processing
- Ornamentals

By maturity date:

- Early (70-90d)
- Mid-season (90-110d)
- Late (110-130d)

3

A Multipurpose Plant

Fruits

- Fresh eat
- Drying
- Processing
- Culinary uses
- Drinks
- Wine
- Medicinal uses (dry fruit and seeds)

Wood: very hard

Nectar plants (?)

4

Adaptability

- Wide adaptability to soil and weather conditions
- **Late season startup-leaf out in late April or May at Alcalde**
- Heat and drought tolerance
- **Precocious, reliable crop, and long-live plants**
- Varied tree shapes, fruit shapes and sizes
- Winter hardy in NM (-20˚F?)
- Few insect and disease problems (peach moth and leaf spot)

Avoid late cultivars in short growing season area (<150 d, northern NM and high elevations).

5

Shoot structure and fruiting habit

- Primary shoot
  - Secondary shoots
    - Fruiting spurs
      - Fruit bearing shoots (branchlets)

6

Shoots and buds

Four kinds of shoots:

- Primary shoot (extension shoot)
- Lateral/secondary shoot
- Mother bearing shoot (fruiting spur)
- Fruit-bearing shoot (branchlet)

Three kinds of buds:

- Main bud
- Lateral bud
- Dormant buds

BE BOLD. Shape the Future.
New Mexico State University
aces.nmsu.edu

7

Lateral shoots: permanent , Base of fruiting structure

Primary shoot:
One **terminal bud** on top, one **lateral bud** at the base of each lateral branch- keeping dormant most of the time. Can grow to primary shoot if stimulated.

BE BOLD. Shape the Future.
New Mexico State University
aces.nmsu.edu

8

Lateral shoot: thorn/spines on each node, extremely bad in nursery.

9

Fruiting spurs (mother bearing shoots) actually are **compacted shoots**. The associate buds around the main buds send out several branchlets each season to bear fruits.

BE BOLD. Shape the Future.
New Mexico State University
aces.nmsu.edu

10

Old fruiting spurs and branchlets

BE BOLD. Shape the Future.
New Mexico State University
aces.nmsu.edu

11

The main bud of fruiting spur can transform to primary shoot depending on cultivar or stimulation.

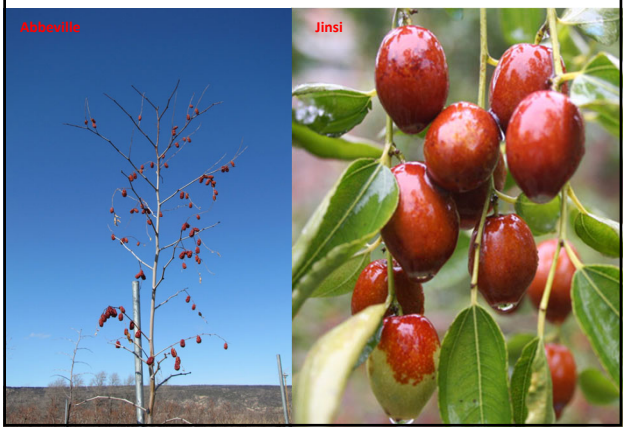
Sugarcane

Sihong

So

12

BRANCHLETS: have leaves and flowers, drop at the end of the season.



13

Function of shoots

- **Primary shoots**: form the scaffolds of the tree and responsible for the expanding of fruiting area.
- **Lateral shoots**: always accompany the primary shoot. Base of the fruiting structure.
- **Fruiting spurs**: also called *mother bearing shoots*, responsible for initiating fruiting structure. Could transform to primary shoot if stimulated.
- **Branchlets**: also called *fruit-bearing shoots*, fruiting structure.

14

Pruning

- Minimum compared with other fruit species
- Do not response as well as other tree fruit species like apples or peaches
- Do need attention especially for young trees
- Heading cut- need two cuts for jujubes (**one cut stops, two cuts sprout**!)
- **Self-pruning**: later branches die back when aging.
- Primary shoots from fruiting spurs on secondary shoots are preferred than those directly from the main trunk.
- Shorten secondary shoot to stimulate primary shoot
- Remove over crowded, damaged/diseased primary shoots
- Pruning and training vary by locations. In CA, Li trees produce well on one-year-old shoots.

Jujube training and pruning basics: https://aces.nmsu.edu/pubs/_h/H337.pdf

15

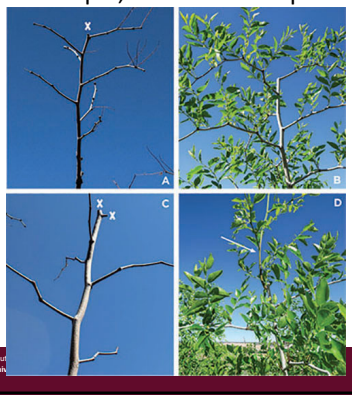
Shorten lateral branches to stimulate primary shoot

16

Shoots from secondary branches are preferred!

17

One cut stops, two cuts sprout!



18

Propagation

- Root suckers- only if the mother plants are from root suckers.
- Grafting: widely used in nurseries. Use wild jujubes as rootstocks.
- Cleft grating, bark grafting and whip/tongue grafting work well.
- Tissue culture?

https://www.youtube.com/watch?v=fFLwOWe0KQ4

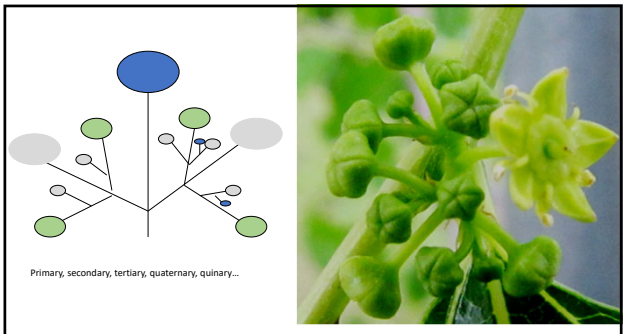
19

20

Flowering and fruiting

- Jujubes finish flower bud initiation, blooming, setting fruit and fruit mature with **one growing season**.
- One flower blooms for a day but a tree blooms for 2 months!
- For jujubes, branchlet growth, flower bud initiation, blooming, setting fruit and fruit development occur at the same time within the same branchlet. (**Nutrient competition**!)

21



Fitzgerald

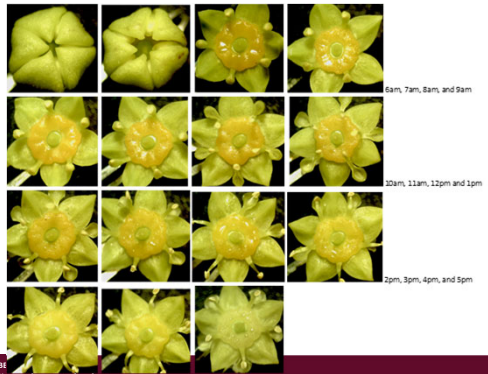
Definite Inflorescence: Cyme, dichasium

22

Flower initiation: at current year's new growth

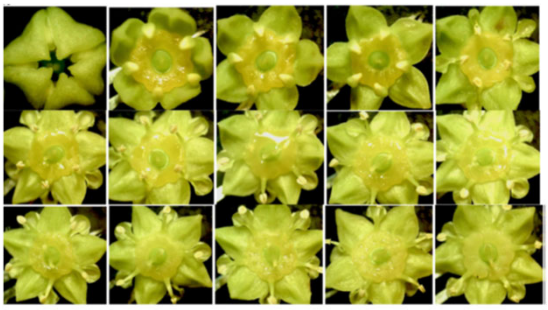
23

Blooming process: 'Lang'- morning type



24

Li: afternoon type



25

Jujube cultivar blooming type

Cultivar	Blooming type	Source	Cultivar	Blooming type	Source
Abbeville	AM	Louisiana	Li-2	PM	California
Ant Admiral	PM	China	Liuyuexian	PM	China
Banzao	PM	China	Maya	PM	China
Chaoyang	PM	China	Miyun	PM	China
Chico	AM	California	Mu	AM	California
Dabailing	PM	China	Mopanzao	AM	China
Daguazao	PM	China	Pitless	PM	China
Don Polenski	AM	California	Qiyuexian	PM	China
Dragon	PM	China	Redland	PM	California
Edhegard	AM	Alabama	Russia-2	AM	California/Russia
Fitzgerald	AM	Georgia	Sept Late	PM	California/China
Fuping	AM	China	Shanxi Li/Linyi Li	PM	China
GA-866	PM	California	Sherwood	PM	Louisiana
GI-1183	AM	California	Shuimen	AM	California/China
Globe	AM	China	Sihong	PM	California/China
Honeyjar	PM	China	So	AM	California
Hupingzao	AM	China	Sugarcane	AM	California
Jin	PM	China	Sui	AM	California
Jinkuiwang	PM	China	Teapot	PM	China
Jing-39	AM	China	Topeka	PM	Kansas
Jinsi-2	PM	China	Tsao	PM	Pennsylvania
Jinsi-3	PM	China	Thornless	AM	California
Jinsi-4	PM	China	Xiangzao	AM	China
Jixin	AM	China	Xingguang	AM	China
Junzao	AM	China	Youzao	PM	China
Kongfucui	PM	China	Yuanling	PM	China
Lang	AM	California	Zaocuiwang	AM	China
Li	PM	California	Zhongning	PM	China

26

Self fertility/self fruitfulness

- Self pollination cultivars: Li, Li(2), Redland, Daguazao, Alcalde #1, Xiangzao, and Dabailing.
- Popular cultivar Lang was not self fruitful.
- Zaocuiwang has no pollen.
- Recommend two cultivars for cross pollination.

27

Fruit set of jujube cultivars

- Cultivar
- Weather conditions (temperature and moisture)
- Cross pollination
- Insect activities
- Nutrient competition (vegetative growth)
- Cultural management (girdling, gibberellin spray etc.)

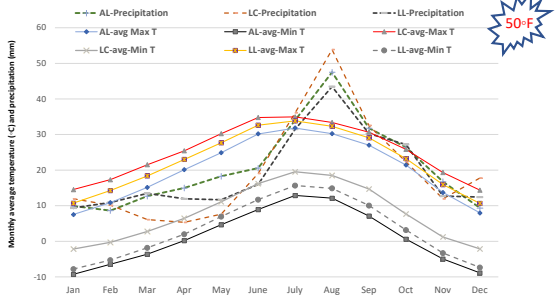
28

Jujube Cultivar trial location in NM

- **Alcalde (2015): USDA 6a; Density 8x12ft**
- **Los Lunas (2015): USDA 7a; Density: 10x15ft**
- **Leyendecker (2017): USDA 8a. Density: 10x15ft**

29

Historic weather data (monthly average max and min temperatures and precipitation) for Alcalde (AL, 1953-2005, 51°F/9.9"), Las Cruces (LC, 1959-2005, 61.7 °F/9.21") and Los Lunas (LL, 1923-2005, 55.4°F/9.1").



30

Table 1. Fresh eating cultivar names, sources and their planting locations. AL-Alcalde, LL-Los Lunas, and LK-Leyendecker.

	Cultivar	Plant source	Planting locations
1	Alcalde #1(Qiyuexian)[z]	China	AL, LL, and LK
2	Chico	California	AL[y], LL[y], and LK
3	Dabailing[z]	China	LK
4	Daguazao[z]	China	AL, LL, and LK
5	GA866	California	AL, LL, and LK
6	Gaga[z]	China	AL, LL and LK
7	Honeyjar	California	AL, LL and LK
8	Jing 39[z]	China	LK
9	Li	California	AL, LL and LK
10	Kongfucui (KFC)[z]	China	AL, LL and LK
11	Maya[z]	China	AL, LL and LK
12	Redland	California	AL, LL and LK
13	Russian 2	California	AL[y], LL[y] and LK
14	Sandia[z]	China	AL, LL
15	Shanxi Li	China	AL, LL and LK
16	Sugarcane	California	AL, LL and LK
17	Zaocuiwang[z]	China	AL, LL and LK

[z] Cultivars under trademark AmeriZao® series.
[y] Cultivars were tested as observation only, not in the replicated trials.

31

Table 2. Jujube cultivar yields (g/tree) from 2016-18 at Alcalde and Los Lunas, NM

Cultivar	AL-2016	AL-2017	AL-2018	LL-2016	LL-2017	LL-2018
Alcalde #1	451	1511	3202	892	607	4988
Daguazao	646	6547	9948	79	3070	5013
GA866	68	977	1797	311	1932	3658
Gaga	238	5953	6321	456	1835	5707
Honeyjar	1148	7470	6160	229	1642	5701
KFC	383	11572	13686	339	2696	9791
Li	80	4267	3756	210	6681	8377
Maya	538	5995	6432	643	2623	6446
Redland	431	6387	3985	1015	8265	8999
Sandia	18	132	2576	167	2060	3183
Shanxi Li	512	3503	1842	509	3870	4559
Sugarcane	423	6366	8500	868	2852	3882
Zaocuiwang	387	1659	925	209	2135	6734
Mean	409	4795	5318	456	3098	5926
Critical value[z]		3427	2311		2217	4457
Chico[y]	32	859	2127	681	1892	4195
Russian 2	1700	4066	1160	1620	-	-

32

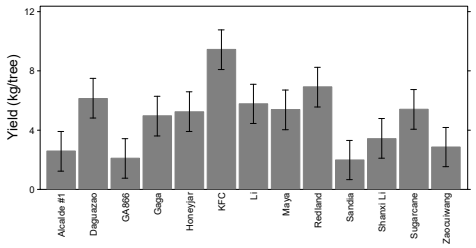
Table 3. Fruit size, mean fruit weight and soluble solids of different jujube cultivars at Alcalde and Los Lunas in 2017 and 2018.

	Fruit dimension-2017 (length x width, mm)		Mean fruit weight (g)				Soluble solids (%)[z]			
	AL	LL	AL-17	LL-17	AL-18	LL-18	AL-17	LL-17	AL-18	LL-18
Alcalde #1	51.8 × 36.6	48.8 × 38.1	29.8	31.2	26.3	25.8	30.9	32.8	32.8	28.9
Chico	27.8 × 33.1	29.7 × 34.6	13.4	14.3	--	--	22.7	24.2	--	--
Daguazao	39.3 × 38.0	39.5 × 41.9	22.9	27.1	21.1	17.1	27.6	28.7	27.0	25.4
GA866	43.9 × 24.5	47.3 × 27.9	10.7	14.8	12.9	14.1	27.9	29.2	35.2	32.9
Gaga	39.7 × 21.1	37.9 × 21.1	7.6	8.8	6.6	7.4	35.3	34.4	--	29.5
Honeyjar	24.1 × 25.0	24.7 × 24.9	7.3	7.6	6.9	7.2	24.4	33.6	27.9	32.3
KFC	39.7 × 26.2	39.0 × 28.0	11.5	12.6	10.1	14.2	29.0	32.7	25.2	31.3
Li	42.1 × 40.7	44.4 × 42.5	27.5	29.0	25.0	30.2	23.6	28.4	31.8	29.7
Maya	39.4 × 20.6	39.2 × 21.5	7.0	7.2	6.6	7.5	29.0	33.7	30.5	28.7
Redland	44.2 × 42.1	43.4 × 43.6	31.6	26.8	22.3	27.9	28.7	27.9	29.4	30.8
Sandia	31.7 × 31.7	29.3 × 30.8	14.8	14.3	9.5	16.4	33.0	34.6	36.5	34.3
Shanxi Li	43.8 × 39.6	42.1 × 41.4	27.3	21.3	17.1	17.0	25.2	29.9	28.7	32.1
Sugarcane	34.1 × 26.6	31.1 × 25.0	11.7	8.8	9.9	11.5	28.6	27.5	27.1	30.5
Zaocuiwang	37.8 × 30.5	42.4 × 37.7	18.4	20.8	19.83	25.4	30.1	34.3	29.5	32.3

[z] The soluble solids were extracted with a garlic press and measured with a digital refractometer from a composite sample of 8–10 fruit per cultivar with a wedge from each fruit.

33

Figure 1. Average yields of 13 fresh eating jujube cultivars at both Alcalde and Los Lunas across 2017 and 2018. The bars are 95% confident interval error bars and if they do not overlay, the different between two means are significant at $P \leq 0.05$.



34

Figure 2. Fruit pictures of different jujube cultivars in New Mexico. A-Alcalde#1, B-Chico, C-Dabailing, D-Daguazao, E-Gaga, F-Honeyjar, G-KFC, H-Li, I-Maya, J-Redland, K-Russian 2, L-Sandia.

35

Fresh eating cultivar summary

- Dongzao had the best fresh eating quality in my collection. (Not precocious)
- Honeyjar, Maya/Gaga and Russian 2 had excellent fruit quality, productive but small in fruit size, very suitable for home gardeners.
- Kongfucui, Li/Shanxi Li/Redland/Daguazao/ Dabailing had big fruit and productive.
- Alcalde #1 was the earliest with big fruit, relatively small tree than others. Suitable for marginal regions.

36

Drying/multipurpose cultivars trialed at NMSU Alcalde, Los Lunas and Leyendecker Centers in New Mexico.

Cultivar	Source	Alcalde	Los Lunas	Leyendecker
Chaoyang	China	X	X	
Don Polenski	California	X	X	
Jinkuiwang (JKW)	China	X	X	X
Jinsi 2	China	X	X	X
Jinsi 3	China	X	X	X
Jinsi 4	China	X	X	
Jixinzao	China	X	X	X
Junzao	China	X	X	X
Kongfucui (KFC)	China	X	X	X
Lang	California	X	X	X
Pitless	China	X	X	X
Sherwood	California	X	X	X
Sihong	California	X	X	X
Xiangzao	China	X	X	X
Xingguang	China	X	X	X
Banzao[z]	China	X	X	X
Globe	California	X	X	X
Huizao	China			X
Shuimen	California	X	X	X

[z] Cultivars below the double line in the table are for observation only since there were not enough plants for full replications.

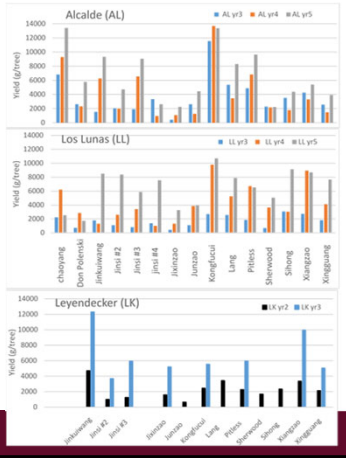
37

Table 2. Tree growth of drying and multipurpose cultivars at Alcalde (AL) and Los Lunas (LL) in March 2018 and Leyendecker (LK) in March 2020.

	Tree height (cm)		Tree width (cm)		Uprightness		Branches			Height (cm)	Width (cm)	Uprightness	Branches
Cultivar	AL	LL	AL	LL	AL	LL	AL	LL	Cultivar	LK	LK	LK	LK
Chaoyang	290	296	194	131	3.0	1.8	5.0	2.7	Banzao	298bc	198bc	3.0ab	8.8bc
Don Polenski	255	283	189	123	3.3	2.0	5.5	3.0	Jinsi 2	284bc	161c	3.0ab	7.1bcd
JKW	284	315	180	205	3.8	2.8	8.0	4.8	Jinsi 3	301abc	184bc	3.0ab	7.3bcd
Jinsi 2	231	271	168	134	3.0	2.5	4.7	3.0	Jixin	334ab	196bc	2.4cd	5.3cd
Jinsi 3	263	303	226	168	4.0	3.0	8.0	6.0	JKW	361a	255a	3.3a	12.5a
Jinsi 4	238	170	150	104	3.3	3.0	3.5	3.5	KFC	270c	180bc	2.8abc	4.5d
Jixin	326	308	219	140	3.0	2.0	4.5	3.8	Lang	301bc	184bc	2.8bc	8.3bcd
Junzao	245	253	185	105	3.3	2.0	5.3	2.8	Sherwood	322abc	195bc	2.2d	9.5ab
KFC	339	308	245	155	3.3	2.3	5.3	4.5	Sihong	336ab	202bc	2.2d	4.5d
Lang	301	273	226	170	3.3	2.3	8.3	4.8	Xiangzao	299bc	215ab	2.5cd	10.8ab
Pitless	231	328	209	175	4.0	2.5	7.5	4.3	Xingguang	279c	161c	3.0ab	8.3bcd
Sherwood	373	367	208	125	3.0	1.1	7.5	2.0	AVG	306	197	2.8	8.0
Sihong	313	343	219	221	3.3	2.8	4.8	6.0	Globe [y]	328	196	2.5	8.5
Xiangzao	313	299	200	166	3.0	2.3	6.0	3.8	Huizai	193	73	2.2	2.0
Xingguang	259	301	175	151	3.3	2.0	6.5	4.5	Junzao	283	175	2.5	5.5
AVG	283	294	200	152	3.3	2.3	6.0	3.9	Pitless	290	183	2.8	5.0
Cultivar	**		**		NS		*		Shuimen	314	191	3.3	11.5
Location	**		**		*		**						
Cultivar×location	*		**		NS		NS						
Banzao[y]	295	288	173	160	2.5	2.5	6.0	5.5					
Globe	332	298	148	158	2.5	2.0	5.0	5.5					
Shuimen	327	320	201	203	3.5	3.0	10.0	4.5					

38

Fig. 2. 2017 jujube cultivar yields from year three to year five after planting at Alcalde and Los Lunas and from year two to year three at Leyendecker site.



39

Table 4. Jujube fruit size, weight, and soluble solids content (SS) at different locations (AL-Alcalde, LL-Los Lunas, LK-Leyendecker).

	Fruit length (mm)		Fruit width (mm)		Avg wt (g) 2017		SS (%) 2017		Avg wt (g) 2019		SS (%) 2019	
Cultivar	AL	LL	AL	LL	AL	LL	AL	LL	AL	LK	AL	LK
Chaoyang	30.1	31.3	21.6	23.1	6.6	10	27.8	31.5	6.5		26.4	
Don P	45.8	43.6	30.7	30.3	17.8	16.2	31.8	35.3	17.5		31.1	
Globe		31.2		32.4		18.4		28.3		21.1		33.7
Jinsi 2	30.7	30.2	23.2	24	8.0	8.7	34.3	33.7	8.7	9.1	31.1	36.1
Jinsi 3	35.7	35.6	26.5	27.8	11.4	10.5	28.3	29.9	10.9	16.2	27.9	36.3
Jinsi 4	27.1	31.2	18.7	22.5	6.6	7.7	28.7	36.9	4.2		27.8	--
Jixin	35.9	35.3	35.1	35.7	11.0	10.6	32.3	33	11.5	12.5	36.2	36.8
JKW	35.7	38.3	26.2	29.3	10.3	13.8	29	27.1	11.5	15.3		38.2
Junzao	43.5	45.1	29.9	30.6	14.5	14.6	25.3	36.2	16.0		28.4	--
KFC	38.7	39	26.1	28	11.2	12.6	30.7	32.7	9.4	13.6	28.2	30.7
Lang	45.7	46.3	32.2	33.7	18.2	17.6	31.4	29.8	15.1		27.2	--
Pitless	28.6	27.4	20.8	20.9	4.9	5	36.2	**42.3**	6.0	5.8	31.1	35.7
Sherwood	40.6	40.2	30.4	31.2	15.9	16.6	27.4	37.8	11.8		25.5	--
Shuimen	39.0	39.6	27.4	28.5	11.7	9.9	28.7	32.2	13.1	15.6	29.6	28.2
Sihong	36.0	36.5	31.8	39.7	16.0	14	30.6	35.2	15.2	17.2	32.7	36.3
Xiangzao	40.2	40.3	32	34.9	16.9	18	28.2	29.4	12.6	19.1	26.3	32.9
Xingguang	43.2	43.1	28.7	30	14.5	14.2	29.7	32.2	14.6	15.8	32.2	30.1
AVG	**37.3**	**37.3**	**27.6**	**29.6**	**12.2**	**12.8**	**30.0**	**33.1**	**11.5**	**14.7**	**29.4**	**34.1**

40

Fig. 3. Cultivar dry fruit pictures. AL-Alcalde, LL-Los Lunas, LK-Leyendecker, O-oven drying, S or no extra mark is sun drying. Most pictures in the first two rows were samples from Alcalde in 2014, which was a relatively longer growing season.

First row: Globe-AL-2014, KFC-AL-2014, Jinsi 2-AL-2014, Jinsi 3-AL-2014, Jixin-AL-2014, JKW-Al-2014.
Second row: Lang-AL-2014, Shuimen-AL-2014, Sugarcane-AL-2015, Xiangzao-AL-2015, Sherwood-LL-2014.
Third row: Lang-LL-2018, Jinsi 3-LK-2018, Sihong AL vs. LK 2018, Jixin-LK-2018, Xiangzao-LL-2018

41

Drying and multipurpose cultivar summary

- Jinsi 2, jinsi 4, Pitless and Huizao had smaller trees than others.
- Sihong and Jinkuiwang had bigger trees than others.
- Same cultivar, the trees in southern part are larger and produce high yield with bigger fruit and higher soluble solids than those in northern NM.
- **Jinsi series, Sihong, Jixin and Huizao had excellent drying quality**
- Xiang was drying only cultivar, productive in southern part with OK drying fruit quality.
- KFC and Sherwood can be used for both fresh eating and drying.

42

Alcalde #1

- Earliest cultivar at Alcalde (excellent for the marginal regions, good for other regions).
- Large fruit
- Precocious
- Good quality

43

Honeyjar

- Small fruit
- Excellent fresh eating quality
- Precocious and productive
- Fruit shrank when matures especially in hot areas

44

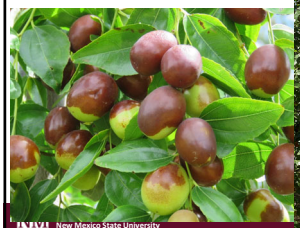
Maya

- Football shaped, good-looking fruit
- Excellent quality
- Small/medium size

45

Russian 2

Small fruit
Excellent fruit quality
Precocious and productive
Very suitable for home gardeners



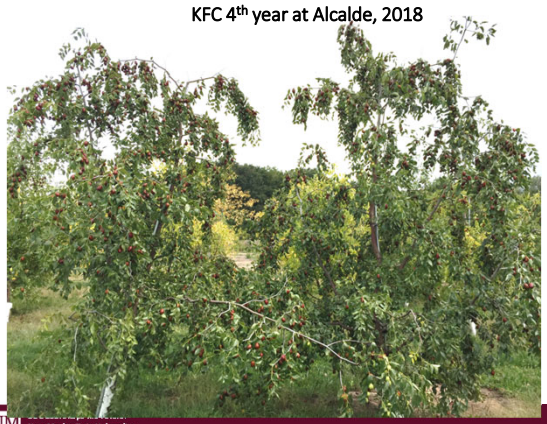
46

KFC

Shiny and bumpy fruit
Very precocious and productive across NM
Good quality
Mid season in maturation

47

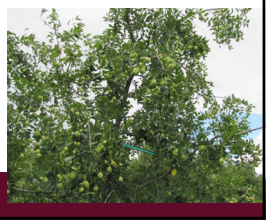
KFC 4th year at Alcalde, 2018



48

Li

- Large fruit
- Mid season
- Productive
- Good quality
- Fruits do shrink when it colored.

49

Sugarcane

- Mid season
- Sweet fruit, medium in size
- Good for both fresh eating and drying


50

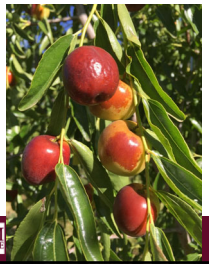
Dongzao

- Late cultivar
- Can be stored for 2-3 months
- Super fresh eating quality
- Dominant fresh eating cultivar in China


51

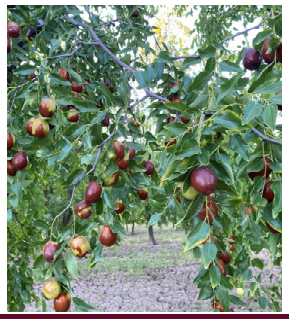
Sandia

Hebei Dongzao or a mutation of it
Super fresh eating quality
Not very precocious
Zone 7 and up
Marginal in Zone 6




52

Varied by locations



- Sherwood produces well in Los Lunas and Leyendecker Center
- Jing 39 and an unknown did well in Leyendecker
- KFC, Honeyjar, Maya, Jinsi 2, JKW and Pitless did well in all three locations
- In 2022 and 2023 average yields were 40lb/tree with maximum of 90-100lb/tree

53

Jing 39


54

Jixin at Leyendecker

55

4th year at Leyendecker

56

Drying cultivars:

- Lang/Don Polenski/Thornless/Ed Hegard; Junzao, Sugarcane: mid season
- Sherwood: late cultivar
- Jinsi series, Jixin
- Sihong (excellent quality), not a heavy producer in NM, good in CA
- **Huizao/Junzao**-dominant one in Xinjiang area

Dry jujubes: large or small, all has its own uses.

57

Ornamental cultivars

- So: early-mid season, productive, four-season edible landscape plant
- Dragon: dwarf tree, four season edible landscape plant
- Mushroom: large tree, beautiful fruit
- Teapot: large tree, late fruit in varied shapes

http://horttech.ashspublications.org/content/28/4/557.full.pdf?ijkey=DdYI7VH4QvtsxQd&keytype=ref

- To me, So is the most useful ornamental cultivar: compact tree, zig-zagged growing habits, good for fresh eating and drying, four-season edible ornamental/landscape tree.

58

59

So

60

Dragon

61

Summary

- Threshold: annual average temperature of 50°F/10 °C
- USDA hardiness zone is not very helpful to determine jujube suitability since it is based on minimal winter temperature only. (Heat accumulation should be considered).
- Fruit sizes are bigger and sweeter in southern part than in northern NM.
- In New Mexico, Espanola/Alcalde is the marginal region, can grow early to mid-season fresh eating cultivar, no late cultivar or drying cultivars for commercial growers.
- In southern New Mexico, both fresh eating and drying, from early to late in maturation, all grow and produce well.
- In central New Mexico, majority of fresh eating cultivars, and most drying cultivars are doing well except really late drying cultivars.

62

Some notes from recent years observation

- Most cultivars produced heavier, and trees grew more in southern NM.
- Fruit of several cultivars shrank badly when they were past half/half or fully red stage: Li group, Honeyjar especially in southern part. Critical issue for fresh eating cultivars.
- Russian 2 held its firmness better than Honeyjar.
- The early cultivars had shorter harvesting period due to the hot weather in southern NM.

63

References

- **https://jujube.nmsu.edu/**
- Yao, S. 2023. Jujube, Chinese date in New Mexico. NMSU Cooperative Extension Service Publication H330. https://pubs.nmsu.edu/_h/H330.pdf
- Yao. S. 2019. Guide H337: Jujube training and pruning basics. https://pubs.nmsu.edu/_h/H337.pdf
- Yao, S. 2014. Jujube (Ziziphus jujuba) grafting. NMSU Cooperative Extension Service Publication H335. https://pubs.nmsu.edu/_h/H335.pdf
- Yao, S., R. Heyduck, S. Guldan and G. Sapkota. 2020. Early performance of drying and multipurpose jujube cultivars in the southwestern United States. *HortScience* 55:1804-1810. https://doi.org/10.21273/HORTSCI15344-20
- Yao, S., R. Heyduck, and S. Guldan. 2019. Early performance of jujube fresh eating cultivars in the southwestern United States. *HortScience* 54:1941-1946. https://doi.org/10.21273/HORTSCI14312-19
- Yao, S. and R. Heyduck. 2018. Ornamental jujube cultivar evaluation in the Southwestern United States. HortTechnology 28:557-561. https://doi.org/10.21273/HORTTECH04073-18
- **Yao, S.** 2013. Past, present, and future of jujubes—Chinese dates in the United States. HortScience 48:672-680. https://doi.org/10.21273/HORTSCI.48.6.672

64