

Article(*Supplementary materials*)

Optimizing the sowing dates for potato based on different water-temperature year types in the agro-pastoral ecotone of North China

Jinpeng Yang ¹, Yingbin He ^{1,*}, Shanjun Luo ², Xintian Ma ¹, Zhiqiang Li ³, Zeru Lin ³, Zhiliang Zhang ⁴, Jianqiang He ^{4,*}

¹ Institute of Agriculture Resources and Regional Planning, Beijing 100081; 82101195279@caas.cn(J.Y.); mxtexist@163.com(X.M.)

² School of remote sensing and information engineering, Wuhan University; luoshanjun@whu.edu.cn

³ School of Management, Tianjin Polytechnic University, Tianjin, China 300387; 346048222@qq.com(Z.L.); linzeru@hotmail.com(Z.L.)

⁴ Institute of Water-Saving Agriculture in Arid Areas of China, Northwest A&F University, Yangling Shanxi, China 712100; 310947531@qq.com(Z.L.)

* Correspondence: heyngbin@caas.cn(Y.H.); jianqiang_he@nwuaaf.edu.cn(J.H.)

Supplementary Table S1. Coefficient variation (CV) of year-to-year precipitation in different months of the potato growing season.

Site	April	May	June	July	August	September	October
DB	0.83	0.75	0.70	0.58	0.56	0.63	0.78
DL	0.74	0.59	0.43	0.47	0.64	0.50	0.65
DS	1.14	0.82	0.67	0.55	0.57	0.51	0.84
HLE	0.87	0.88	0.60	0.51	0.54	0.69	1.06
LX	0.96	0.74	0.61	0.60	0.67	1.14	1.29
SZWP	0.91	0.81	0.64	0.48	0.56	0.57	0.68
TL	1.18	1.06	0.54	0.64	0.73	0.80	0.85
WNTQ	0.92	0.83	0.63	0.56	0.66	1.02	0.86
XWZM	0.65	0.72	0.62	0.65	0.51	0.62	0.85
YL	0.86	0.75	0.75	0.63	0.68	0.61	0.86
YZ	0.77	0.60	0.58	0.58	0.56	0.48	0.67
ZLTQ	1.18	0.90	0.54	0.66	0.79	0.87	0.93

Supplementary Table S2. Linear regression between the stress index in the tuber formation stage and potato yield.

water-temperature year type	Mean water stress of tuber formation stage Formula	R ²	Mean temperature stress of the whole growing period	
			Formula	R ²
Dry-Hot	y=-34630.4x***+20595	0.575	y=34654x**-22542	0.018
Wet-Hot	y=-32581.8x***+30835.9	0.378	y=-5288x+28870	0
Dry-Cool	y=-39307x***+32288	0.573	y=-51626x+62813	0.007
Wet-Cool	y=-33637.5x***+32138.8	0.681	y=57925x**-30917	0.028

***indicates significance at P < 0.001, ** indicates significance at P < 0.01

Supplementary Table S3. An example of OSP for cultivar Favorita in different water-temperature year types across APE of North China. DOSP represent the duration of OSP.

Site	water-temperature year type	Optimal sowing period		DOSP (days)	Mean peak yield (kg·hm ⁻²)
		open	close		
YZ	Dry-cool	6/10	6/13	4	8395
	Wet-cool	6/4	6/13	10	17139
	Dry-hot	5/11	6/13	34	7578
	Wet-hot	6/10	6/13	4	16442
YL	Dry-cool	5/5	6/4	31	16009
	Wet-cool	6/7	7/1	25	22752
	Dry-hot	5/5	5/17	13	10430
	Wet-hot	6/19	6/30	13	19815
DB	Dry-cool	6/18	7/3	16	21293
	Wet-cool	6/24	7/9	16	28356
	Dry-hot	6/27	7/9	13	14484
	Wet-hot	6/3	6/24	22	26691
DL	Dry-cool	6/5	6/20	16	15866
	Wet-cool	6/8	6/23	16	27694
	Dry-hot	5/9	5/30	22	17161
	Wet-hot	5/9	6/23	46	19873
DS	Dry-cool	4/26	5/11	16	16367
	Wet-cool	6/10	7/1	22	24038
	Dry-hot	5/26	6/19	25	12936
	Wet-hot	6/1	6/16	16	24769
LX	Dry-cool	6/17	6/29	13	6958
	Wet-cool	6/26	7/2	7	17227
	Dry-hot	6/14	7/2	19	2732
	Wet-hot	5/24	6/26	34	12582
SZWQ	Dry-cool	4/23	5/14	22	20695
	Wet-cool	5/20	6/7	19	31145
	Dry-hot	4/29	6/4	37	17903

	Wet-hot	5/2	5/26	25	31196
	Dry-cool	4/19	5/16	28	13436
XWZM	Wet-cool	5/25	6/12	19	24441
	Dry-hot	4/19	5/4	40	9704
	Wet-hot	5/28	6/18	22	21702
	Dry-cool	5/29	6/13	16	11106
HLE	Wet-cool	5/17	6/19	34	21095
	Dry-hot	5/8	5/26	19	7665
	Wet-hot	5/26	6/10	16	23940
	Dry-cool	5/12	7/2	52	14283
TL	Wet-cool	6/2	6/23	22	21784
	Dry-hot	5/21	6/14	25	14234
	Wet-hot	5/21	6/26	37	21318
	Dry-cool	7/3	7/9	7	11521
WNTQ	Wet-cool	6/30	7/9	10	21864
	Dry-hot	7/6	7/9	4	13077
	Wet-hot	5/19	6/9	22	19486
	Dry-cool	4/24	5/15	22	21084
ZLTQ	Wet-cool	5/24	6/14	22	28223
	Dry-hot	5/24	6/8	16	10562
	Wet-hot	5/12	5/27	16	29445

Supplementary Table S4. An example of OSP for cultivar Connibbeck in different water-temperature year types across APE of North China. DOSP represent the duration of OSP.

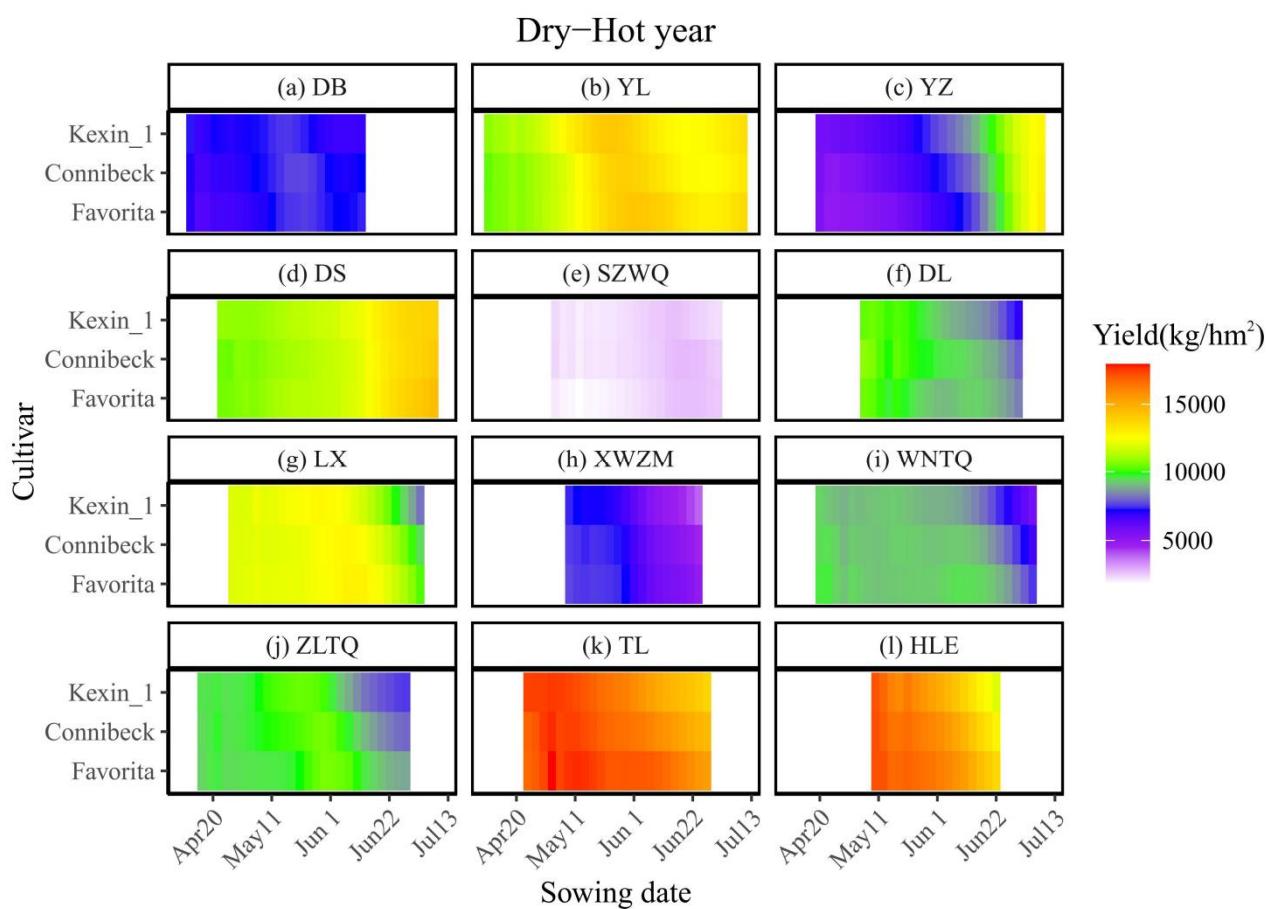
Site	water-temperature year type	Optimal sowing period		DOSP (days)	Mean peak yield ($\text{kg}\cdot\text{hm}^{-2}$)
		open	close		
YZ	Dry-cool	6/10	6/13	4	8325
	Wet-cool	6/4	6/13	10	16723
	Dry-hot	5/11	5/29	19	7659
	Wet-hot	6/7	6/13	7	16058
YL	Dry-cool	5/5	5/26	22	16991
	Wet-cool	6/4	6/28	25	22128
	Dry-hot	5/5	5/17	13	10801
	Wet-hot	5/8	5/17	26	19362
DB	Dry-cool	6/18	7/3	16	20417
	Wet-cool	6/24	7/9	16	27141
	Dry-hot	6/27	7/9	13	14131
DL	Wet-hot	5/31	6/21	22	25912
	Dry-cool	5/30	6/20	22	15403
	Wet-cool	6/8	6/23	16	26441

	Dry-hot	5/9	5/24	16	17196
	Wet-hot	5/9	6/23	46	19514
	Dry-cool	4/26	5/11	16	16421
DS	Wet-cool	6/4	7/1	28	22991
	Dry-hot	5/20	6/16	28	12813
	Wet-hot	5/29	6/13	16	24291
	Dry-cool	6/14	6/29	16	6885
LX	Wet-cool	6/23	7/2	10	16917
	Dry-hot	6/14	6/26	13	2819
	Wet-hot	5/24	6/23	31	12645
	Dry-cool	4/23	5/14	22	20080
SZWQ	Wet-cool	5/14	6/4	22	30010
	Dry-hot	4/26	5/20	25	17687
	Wet-hot	5/2	5/23	22	30305
	Dry-cool	4/19	5/13	25	13202
XWZM	Wet-cool	5/22	6/9	19	24042
	Dry-hot	4/19	6/15	58	9537
	Wet-hot	5/25	6/18	25	20810
	Dry-cool	5/11	6/10	31	11008
HLE	Wet-cool	5/8	6/16	40	20783
	Dry-hot	5/8	5/26	19	7560
	Wet-hot	5/17	6/7	22	23064
	Dry-cool	5/3	7/2	61	13790
TL	Wet-cool	6/2	6/20	19	21318
	Dry-hot	5/18	6/11	25	14003
	Wet-hot	5/21	6/26	37	20773
	Dry-cool	6/30	7/9	10	11218
WNTQ	Wet-cool	6/30	7/9	10	21461
	Dry-hot	7/6	7/9	4	12904
	Wet-hot	5/13	6/9	28	19184
	Dry-cool	4/24	5/15	22	20402
ZLTQ	Wet-cool	5/21	6/11	22	27651
	Dry-hot	5/15	6/5	22	10527
	Wet-hot	5/9	5/27	19	28361

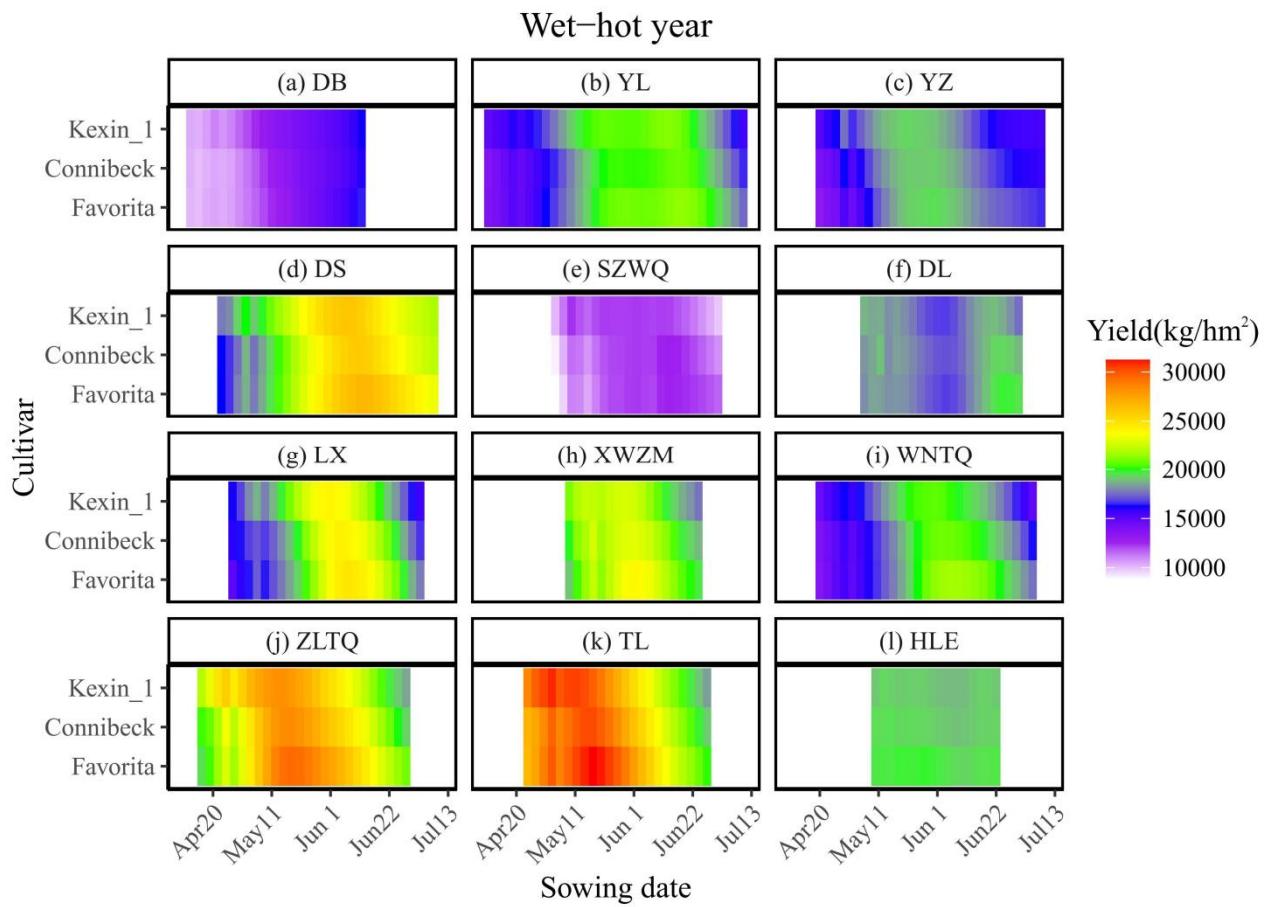
Supplementary Table S5. An example of OSP for cultivar Kexin_1 in different water-temperature year types across APE of North China. DOSP represent the duration of OSP.

Site	Water-temperature year type	Optimal sowing period		DOSP (days)	Mean peak yield (kg·hm ⁻²)
		open	close		
YZ	Dry-Cool	6/15	6/30	16	20217
	Wet-Cool	6/21	7/9	19	27220
	Dry-Hot	6/21	7/9	19	13902
	Wet-Hot	5/28	6/15	19	26082
YL	Dry-Cool	5/5	5/17	13	17362
	Wet-Cool	5/5	5/21	25	21420
	Dry-Hot	5/5	5/23	19	10426
	Wet-Hot	5/5	5/21	32	18866
DB	Dry-Cool	6/7	6/13	7	8414
	Wet-Cool	5/29	6/13	16	16871
	Dry-Hot	5/2	5/26	25	7524
	Wet-Hot	6/7	6/13	7	16217
DL	Dry-Cool	5/12	6/17	37	15122
	Wet-Cool	6/5;6/12	6/23;6/29	19	26142
	Dry-Hot	5/9	5/21	13	17108
	Wet-Hot	5/9;6/13	6/23;6/28	46	19340
DS	Dry-Cool	4/26	5/11	16	16081
	Wet-Cool	5/26	6/28	34	22675
	Dry-Hot	5/5	6/10	37	12712
	Wet-Hot	5/26	6/7	13	24067
LX	Dry-Cool	6/11	6/26	16	6654
	Wet-Cool	6/23	7/2	10	16636
	Dry-Hot	6/8	6/20	13	2704
	Wet-Hot	5/9	6/17	40	12399
SZWQ	Dry-Cool	4/23	5/8	16	20519
	Wet-Cool	4/29	6/1	34	29886
	Dry-Hot	4/23	5/20	28	17491
	Wet-Hot	4/26	5/17	22	30920
XWZM	Dry-Cool	4/19	5/7	19	13120
	Wet-Cool	5/16	6/3	19	24077
	Dry-Hot	4/19	6/3	46	9383
	Wet-Hot	5/19	6/12	25	20562
HLE	Dry-Cool	5/8	6/4	28	10886
	Wet-Cool	5/8	6/7	31	20864
	Dry-Hot	5/8	5/23	16	7374

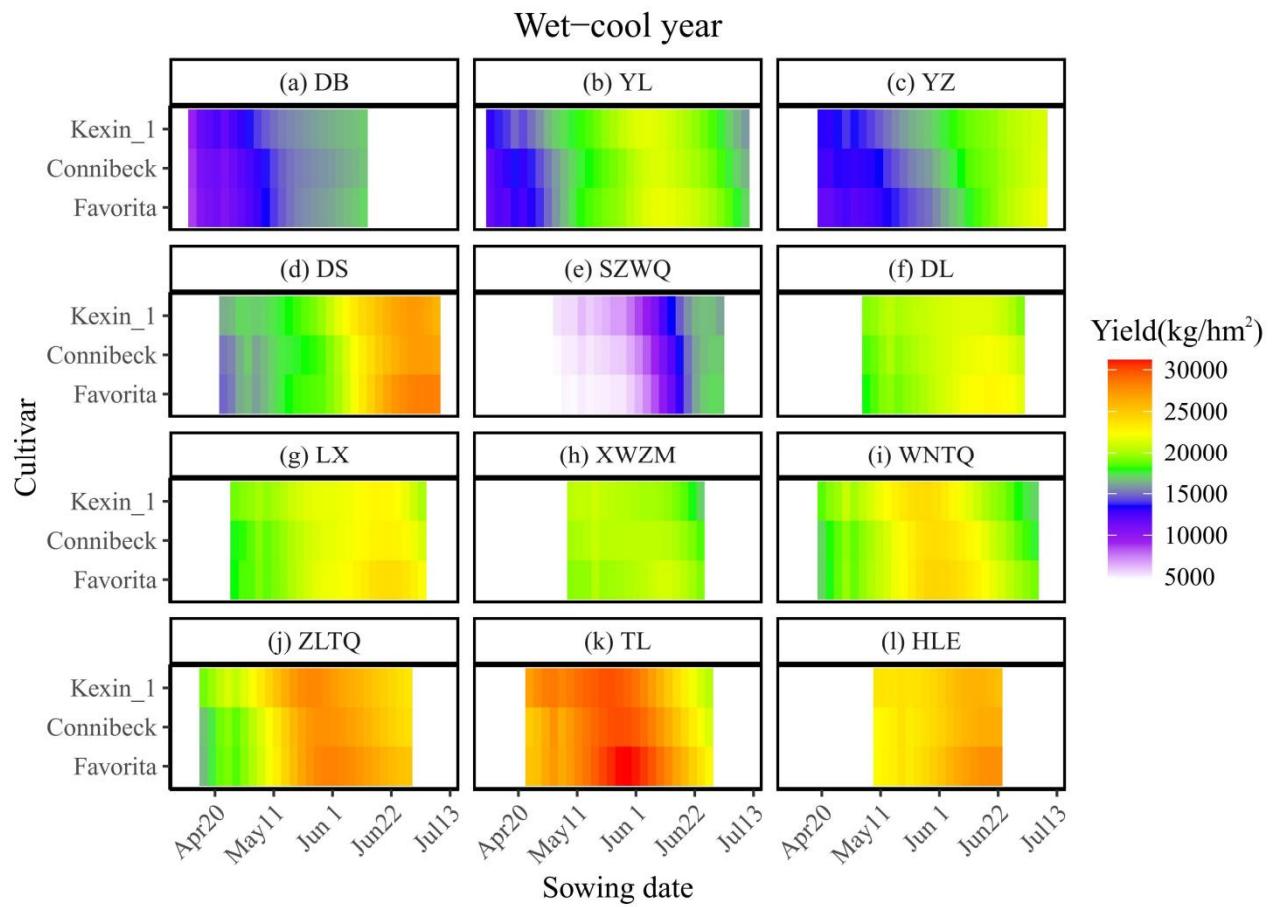
	Wet-Hot	5/11	6/4	25	22767
	Dry-Cool	4/27	6/26	61	13788
TL	Wet-Cool	5/27	6/14	19	21528
	Dry-Hot	5/15	6/2	19	14175
	Wet-Hot	5/15	6/20	37	21132
	Dry-Cool	6/30	7/9	10	11188
WNTQ	Wet-Cool	6/27	7/9	13	21216
	Dry-Hot	7/3	7/9	7	12728
	Wet-Hot	5/10	6/3	25	19303
	Dry-Cool	4/21	5/9	19	20862
ZLTQ	Wet-Cool	5/18	6/5	19	27958
	Dry-Hot	5/6	5/30	25	10383
	Wet-Hot	5/6	5/24	19	28199



Supplementary Figure S1. Yield variations across APE of North China with regard to cultivars and sowing dates in dry-hot years. Different horizontal bands represent different cultivars. (a-l) refers to different meteorological stations in the APE of North China.



Supplementary Figure S2. Yield variations across APE of North China with regard to cultivars and sowing dates in wet-hot years. **Different horizontal bands represent different cultivars. (a-l) refers to different meteorological stations in the APE of North China.**



Supplementary Figure S3. Yield variations across APE of North China with regard to cultivars and sowing dates in wet-cool year. Different horizontal bands represent different cultivars. (a-l) refers to different meteorological stations in the APE of North China.