भाकृअनुप
ICAR

Report of research trial

On

Evaluation of ProPhite (potassium salt of active phosphorus) against anthracnose disease in grapes.

(2016 – 2017)

Sponsored By

Isha Agro India

Pune

Conducted By

राअंअनुके
NRCG

ICAR - National Research Centre for Grapes, Pune

PROJECT REPORT

Project Title : **Evaluation of ProPhite (potassium salt of active phosphorus) against anthracnose disease, in grapes.**

Objectives : **Understanding the evaluation of bio-efficacy and phytotoxicity of ProPhite (potassium salt of active phosphorus) against anthracnose disease in grapes.**

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Indu Sawant
Principal Scientist and Co-PI

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Director

Bio efficacy and phytotoxicity of ProPhite (potassium salt of active phosphorus) against powdery mildew and anthracnose disease in grapes.

1. Introduction

1.1 Anthracnose

In major grape growing areas in Maharashtra, Andhra Pradesh and Karnataka regions adjoining Maharashtra, 'two pruning - one yield' system of grape cultivation is followed wherein foundation pruning is done during April and forward pruning is done during October. In most grape growing areas mentioned above, normal time of forward pruning is around 15th of October, but it can range from first week of July to last week of November. After foundation pruning till October the canes are developed and matured. From April to first week of June, usually the climate is hot (35-40 ^{0} C) and dry (>40% RH). Hence there is least possibility of development of any disease. However, after the monsoon sets in during the second week of June, it can rain any time till middle of October. In most grape growing areas 300 to 500 mm rain received annually and there are about 30-45 days recording more than 4 mm rain per day from June to October. By the time monsoon sets in, most of canes have developed more than 12 leaves and shoot growth is normally brought under control.

Anthracnose caused by the fungus, *Elsinoe ampelina* is characterized by lesions on shoots, leaves and berries. However, according to a recent report, the emergence of *Colletotrichum gloeosporioides* sensu lato as the dominant pathogen of anthracnose disease of grapes in India is evident by culture, morphological and molecular data. The disease is also incited by *Colletotrichum gloeosporioides*. Lesions will first appear on young shoots, showing up as small circular reddish spots that will later become larger and create gray lesions which appear sunken. The lesions will eventually develop margins that are a dark reddish-brown to violet color. If left untreated, lesions on shoots will become larger and eventually kill the shoot. Anthracnose lesions on leaves and petioles look very similar to those on shoots. However, on leaves, the lesions will have dry grey or white centers that will eventually fall off, leaving a hole. This response by the plant is called a shot-hole. Use of fungicides and disease free planting materials are the major tools for the management of the disease.

2. Material and methods

2.1. Bio-efficacy of ProPhite (potassium salt of active phosphorus) against anthracnose disease in grapes .

2.1.1. Anthracnose

The experiment was conducted in vineyard of Thompson seedless variety grown on Bower system of training at ICAR-NRCG campus between, from July to August, 2017 experiment was laid out in RBD with four replications.

Isha Agro India, Narayan Peth, Pune supplied test fungicide Prophite and Potassium phosphite (fosphonic). Thiophenate methyl 70% WP was purchased from local market and used as standard checks. Sprays of these fungicides were given whenever the weather conditions were favorable for development of anthracnose disease. Weather data for period of experimentation is given in Annexure 1. Based on the favorable weather conditions four sprays were given between 3rd July 2017 and 25th July 2017 for anthracnose disease management. Details of treatments are given in Table 1 (c). Dates of foundation pruning and fungicide sprays at the location are mentioned in Table 1 (d)

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Table 1 (c). Details of treatments for field trial

Sr. no.	Treatment details	Dose
		Formulation (g or ml/L)
1.	Thiophenate methyl 70% WP	0.71
2.	ProPhite	4.0
3.	ProPhite followed by Thiophenate methyl (3 applications)	4.0 + 0.71
4.	ProPhite followed by Thiophenate methyl (2 applications) followed by successive application of ProPhite	4.0 + 0.71
5.	Potassium phosphite (fosphonic)	3.0
6.	Potassium phosphite (fosphonic) followed by Thiophenate Methyl (3 applications)	3.0 + 0.71
7.	Potassium phosphite (fosphonic) followed by Thiophenate methyl (2 applications) followed by successive application of Potassium phosphite (fosphonic)	3.0 + 0.71
8.	Control	-

Table 1 (d). Dates of pruning and fungicide sprays for anthracnose

Date of pruning : 15/05/2017			
Spray no.	**Date of spray**	**Days after pruning**	**Type of spray**
1	03/07/2017	49	Preventive
2	11/07/2017	57	Curative
3	18/07/2017	64	Curative
4	25/07/2017	71	Curative
Date of harvesting: - NA			

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2.1.2. Foliar infection

For Anthracnose

Anthracnose incidence on leaves was recorded visually adopting the 0-4 scale, where 0 means no disease present and 4 means more than 75 per cent leaf area infected. Rating scale on leaves has been shown in Fig 1. Percent disease index (PDI) was calculated by following formula:

$$PDI = \frac{\text{Sum of numerical ratings} \times 100}{\text{Number of leaves observed} \times \text{Maximum of rating scale}}$$

The ratings on ten leaves were recorded on randomly selected canes. Ten such canes per vine were observed, thus 100 disease observations were recorded per replicate. Four replications for each treatment were considered. Only actively growing anthracnose lesions were considered for recording ratings.

2.2 Statistical analysis

The PDI data was transformed by using arcsine transformation for leaves and bunches and analyzed statistically following Randomized Block Design (RBD) using Statistical Analysis System (SAS software 9.3).

3. Results

First disease observation on leaves in experimental plot was recorded on 10th July 2017, when 56 days had passed after foundation pruning one preventive spray for anthracnose were already given.

ProPhite @4.0g/L followed by thiophenate methyl (3 applications) @ 0.71 g/L and ProPhite @ 4.0 g/L followed by thiophenate methyl (2 applications) @ 0.71 g/L followed by successive application of ProPhite @ 4.0 g/L water treatment recorded a significantly

lower PDI (22.88 and 23.70 respectively) of anthracnose on leaves than the untreated control (32.24). Both the doses of the test fungicide also had a lower PDI but it is on par with thiophenate methyl 70% WP (24.14) but ProPhite @4.0g/L followed by thiophenate methyl (3 applications) @ 0.71 g/L was significantly lower than ProPhite @ 4 g/L (26.08) during the last observation (Table 3). During the first observation on 18.07.2017 also, the PDI values recorded in thiophenate methyl 70% WP, ProPhite, ProPhite followed by thiophenate methyl (3 applications) and ProPhite followed by thiophenate methyl (2 applications) followed by successive applications of ProPhite were lower than the untreated control (Table 3). Thus. in control of Anthracnose disease on leaves of grapes, integration of spray application of prophite with thiophanate methyl resulted in lowering number of sprays of chemical fungicide thiophenate methyl.

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Table 4. Bio-efficacy of ProPhite (potassium salt of active phosphorus) in control of anthracnose on leaves of grapes after foundation pruning.

Sr. no.	Treatment details	Dose	PDI of anthracnose (%) on leaves			
		Formulation (ml or g/L)	11/07/2017	18/07/2017	25/07/2017	29/07/2017
1.	Thiophenate methyl 70% WP	0.71	0 (0.00)	8.43 (16.83)	11.88 (20.09)	16.75 (24.14)
2.	ProPhite	4.0	0 (0.00)	10.12 (18.47)	13.38 (21.41)	19.37 (26.08)
3.	ProPhite followed by thiophenate methyl (3 applications) followed by successive applications of ProPhite	4.0 + 0.71	0 (0.00)	8.25 (16.66)	10.44 (18.83)	15.12 (22.88)
4.	ProPhite followed by thiophenate methyl (2 applications) followed by successive application of ProPhite	4.0 + 0.71	0 (0.00)	8.63 (16.99)	11.06 (19.30)	16.18 (23.70)
5.	Potassium phosphite (fosphonic)	3.0	0 (0.00)	11.38 (19.62)	15.88 (23.38)	22.12 (27.98)
6.	Potassium phosphite (fosphonic) followed by thiophenate methyl (3 applications)	3.0 + 0.71	0 (0.00)	10.06 (18.48)	11.44 (19.76)	17.43 (24.64)
7.	Potassium phosphite (fosphonic) followed by thiophenate methyl (2 applications) followed by successive application of Potassium phosphite (fosphonic)	3.0 + 0.71	0 (0.00)	10.75 (19.13)	12.13 (20.36)	18.06 (25.09)
8.	Control	-	4.94 (12.83)	13.81 (21.80)	19.38 (26.06)	28.50 (32.24)
	CD (P = 0.05)	-	0.21	2.35	2.29	2.71

*= Figures in parenthesis indicate arcsine transformed averages

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4. Conclusion

- ProPhite @ 4.0 g/L followed by thiophenate methyl (3 applications) @ 0.71 g/L followed by successive applications of ProPhite @ 4.0 g/L water and ProPhite @ 4.0 g/L followed by thiophenate methyl (2 applications) @ 0.71 g/L followed by successive applications of ProPhite @ 4.0 g/L water treatment recorded a significantly lower PDI of anthracnose on leaves than the untreated control

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Annexure – I

Weather Data: - October 2016 to March 2017
Location: NRCG, Pune

Date	Precipitation [mm]	HC Air Temperature [°C]			HC Relative Humidity [%]	Dew Point [°C]	
	sum	aver	min	max	aver	aver	min
2016-10-01	10.2	27.2	21.4	34.9	68.4	19.8	16.5
2016-10-02	6.7	24.7	21.5	33.3	89.6	22.4	20.4
2016-10-03	4.5	24.9	21.6	31.9	86.7	22.2	20.3
2016-10-04	5.9	24.7	21.7	32.5	89.4	22.3	19.6
2016-10-05	2.4	25.4	21.8	32.5	85.6	22.2	19.4
2016-10-06	0.2	25.2	18.5	33.2	73.9	18.6	13.5
2016-10-07	0.3	24.8	16.5	33.8	69.8	17.2	12.3
2016-10-08	0	25.0	16.7	33.9	68.5	17.2	12.9
2016-10-09	0	26.6	19.6	34.7	70.4	19.0	10.9
2016-10-10	0	27.0	22.9	33.4	72.8	21.2	18.4
2016-10-11	3.6	25.3	20.9	32.0	86.4	22.4	20.2
2016-10-12	0.3	25.4	21.0	31.3	82.9	21.8	20.4
2016-10-13	0.3	26.6	20.4	33.7	75.3	20.8	16.0
2016-10-14	0	26.7	20.3	34.7	71.3	18.9	9.4
2016-10-15	0	26.5	18.9	35.8	65.3	17.3	10.3
2016-10-16	0	25.6	17.4	34.5	66.8	17.3	13.6
2016-10-17	0	25.5	18.9	33.4	71.2	18.9	15.9
2016-10-18	0	26.7	21.5	33.1	67.7	19.2	14.5
2016-10-19	0.2	25.2	18.3	33.5	69.1	17.7	11.3
2016-10-20	0	25.0	16.6	34.0	66.8	16.8	12.0
2016-10-21	0	25.9	18.9	33.8	64.9	17.3	10.8
2016-10-22	0	25.8	18.6	34.8	66.4	17.5	11.4
2016-10-23	0	26.5	19.9	35.7	66.3	18.1	13.5
2016-10-24	0	26.9	19.9	35.2	66.8	19.0	13.7
2016-10-25	0	27.4	21.6	33.9	64.0	18.8	14.7
2016-10-26	0	27.0	21.8	33.2	66.3	19.3	13.6
2016-10-27	0.6	25.4	19.4	32.4	70.9	18.5	13.5
2016-10-28	0	24.2	16.7	33.0	69.9	17.0	12.2
2016-10-29	0	24.3	17.6	32.1	70.1	17.3	13.7
2016-10-30	0.2	24.3	15.7	33.3	68.5	16.7	13.3
2016-10-31	0	23.5	16.2	32.7	71.6	16.9	15.5
2016-11-01	0	22.9	15.2	32.0	73.0	16.7	14.5
2016-11-02	0	22.7	13.8	33.4	65.7	14.2	11.0
2016-11-03	0	23.2	14.3	34.0	65.6	15.0	11.4
2016-11-04	0	24.2	15.2	34.2	67.1	16.5	14.2
2016-11-05	0.2	24.6	15.9	33.9	67.8	16.9	14.3
2016-11-06	0	24.1	16.9	34.0	69.1	16.6	12.6

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2016-11-07	0	24.0	16.1	34.7	64.0	15.3	12.9
2016-11-08	0	23.3	14.0	33.9	63.6	14.5	11.2
2016-11-09	0	21.7	13.8	33.9	66.6	13.6	8.1
2016-11-10	0	20.2	12.8	30.8	68.6	12.8	9.9
2016-11-11	0	21.0	11.3	32.4	64.8	12.3	10.1
2016-11-12	0	21.7	13.0	33.4	64.3	13.0	9.7
2016-11-13	0	21.2	11.1	34.0	63.5	11.9	9.1
2016-11-14	0	21.5	11.7	32.5	63.9	12.5	10.3
2016-11-15	0	20.9	11.2	32.6	64.3	12.1	8.9
2016-11-16	0	20.9	11.7	32.4	63.6	11.8	8.5
2016-11-17	0	20.7	10.8	31.9	63.7	11.8	9.6
2016-11-18	0	19.7	9.6	31.1	60.9	9.9	7.2
2016-11-19	0	18.7	8.0	30.7	59.3	8.3	4.9
2016-11-20	0	21.6	11.1	31.3	61.7	13.0	7.4
2016-11-21	0	24.4	18.5	28.7	67.0	17.7	14.3
2016-11-22	1.8	24.8	19.8	31.3	77.9	20.2	18.2
2016-11-23	1.1	23.2	19.7	31.1	92.3	21.5	19.7
2016-11-24	0	23.0	18.1	32.7	88.6	20.5	18.1
2016-11-25	0.2	23.5	19.6	30.9	86.1	20.5	17.0
2016-11-26	0	22.7	16.3	31.7	82.9	18.8	16.3
2016-11-27	0.2	23.0	17.0	31.7	82.3	19.0	15.3
2016-11-28	0	23.0	16.6	32.5	82.8	19.1	16.5
2016-11-29	0	22.2	16.1	30.9	76.1	16.2	10.9
2016-11-30	0	21.3	13.8	31.5	80.5	16.7	13.8
2016-12-01	0	22.5	16.0	31.4	81.9	18.4	16.0
2016-12-02	0	22.6	16.2	33.2	81.3	18.3	15.6
2016-12-03	0.2	21.9	15.0	32.3	82.3	17.9	15.0
2016-12-04	0.2	21.4	14.5	31.1	78.4	16.1	12.7
2016-12-05	0	20.2	12.3	31.0	77.4	14.8	12.0
2016-12-06	0	19.7	11.6	30.2	75.4	13.8	10.0
2016-12-07	0	18.9	10.5	30.8	76.3	13.3	10.2
2016-12-08	0	18.8	10.5	30.4	75.4	12.7	9.5
2016-12-09	0	18.6	8.7	31.1	74.4	12.3	8.3
2016-12-10	0	21.4	11.5	34.0	74.0	15.3	11.1
2016-12-11	0	23.1	15.9	33.2	69.9	15.6	12.3
2016-12-12	0	22.0	12.0	35.8	68.6	14.1	11.4
2016-12-13	0	22.9	13.1	36.5	66.4	14.3	12.1
2016-12-14	0	23.4	14.0	35.6	66.9	15.0	12.1
2016-12-15	0	23.0	14.0	34.3	70.6	15.8	11.9
2016-12-16	0	24.0	15.9	34.6	71.1	17.0	15.1
2016-12-17	0	23.5	15.2	35.3	65.7	14.8	8.1
2016-12-18	0	19.9	10.9	31.1	68.7	12.1	5.5
2016-12-19	0	20.7	11.2	33.1	71.0	13.8	10.1
2016-12-20	0	21.9	13.5	33.1	72.8	15.4	12.9

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2016-12-21	0	20.8	12.0	32.2	70.8	13.6	11.4
2016-12-22	0	18.8	9.9	31.1	70.2	11.6	7.5
2016-12-23	0	17.2	6.0	32.1	66.3	8.6	5.3
2016-12-24	0	15.8	6.3	27.3	67.5	7.9	3.1
2016-12-25	0	14.1	3.6	26.9	67.2	6.1	2.6
2016-12-26	0	13.3	2.1	28.0	64.7	4.3	1.1
2016-12-27	0	14.0	2.6	27.9	62.6	4.1	-0.4
2016-12-28	0	16.4	4.9	30.9	60.2	5.7	1.7
2016-12-29	0	17.4	5.7	32.4	62.0	7.4	4.6
2016-12-30	0	18.0	5.8	33.0	60.5	7.2	2.6
2016-12-31	0	18.2	6.8	32.7	62.3	8.3	4.5
2017-01-01	0	18.3	6.8	33.3	60.6	7.7	2.9
2017-01-02	0	19.4	7.6	33.9	59.1	8.5	5.3
2017-01-03	0	18.4	6.4	33.4	61.6	7.7	1.8
2017-01-04	0	17.5	5.9	32.0	64.2	8.3	4.8
2017-01-05	0	18.0	7.3	32.2	64.3	9.1	6.2
2017-01-06	0.6	18.7	9.0	32.6	65.7	10.2	7.5
2017-01-07	0	19.2	11.5	32.4	66.9	11.4	8.7
2017-01-08	0.2	18.3	9.7	32.2	68.4	10.6	6.0
2017-01-09	0.2	18.7	8.6	32.2	63.5	9.5	6.4
2017-01-10	0	18.3	7.5	32.3	63.6	9.1	6.3
2017-01-11	0	17.7	7.5	31.6	63.6	8.4	4.2
2017-01-12	0	17.9	7.7	31.5	63.3	8.7	6.4
2017-01-13	0	18.6	8.5	30.9	64.7	9.9	7.4
2017-01-14	0	19.1	8.4	31.4	65.7	10.6	5.6
2017-01-15	0.2	19.6	10.1	29.6	69.8	12.5	9.4
2017-01-16	0	21	13.9	31	65.8	13.0	9.3
2017-01-17	0	17.7	7.0	30.6	66.0	9.6	6.1
2017-01-18	0	18.1	7.9	31.0	59.0	7.5	3.2
2017-01-19	0	16.6	6.0	29.6	57.9	6.2	3.9
2017-01-20	0	15.8	4.2	28.9	59.2	5.4	2.8
2017-01-21	0	14.7	3.7	27.6	61.9	5.7	2.3
2017-01-22	0	15.1	2.2	29.1	59.3	4.9	0.6
2017-01-23	0	16.6	5.1	29.6	60.4	7.0	3.3
2017-01-24	0	19.6	10.1	32.9	60.1	9.8	6.6
2017-01-25	0	20.3	8.5	34.1	58.2	9.2	6.0
2017-01-26	0	20.3	7.1	35.5	55.6	8.5	5.7
2017-01-27	0	19.7	7.1	35.2	55.6	7.6	3.2
2017-01-28	0	19.9	5.2	37.1	52.7	5.5	-0.7
2017-01-29	0	19.4	6.7	35.1	56.8	8.3	4.9
2017-01-30	0	20.6	8.0	36.7	55.7	8.8	6.1
2017-01-31	0	22.6	9.7	37.4	52.7	9.5	5.7
2017-02-01	0	22.5	9.9	36.1	53.1	9.6	6.2
2017-02-02	0	21.5	8.3	38.0	50.8	7.2	1.1

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2017-02-03	0	20.1	6.5	37.4	47.3	3.9	-5.1
2017-02-04	0	18.4	3.8	35.6	50.7	5.1	1.7
2017-02-05	0	20.4	6.9	36.3	50.2	6.4	-1.2
2017-02-06	0	20.5	8.0	34.8	57.0	8.5	1.3
2017-02-07	0	21.0	10.6	34.8	60.5	10.9	6.8
2017-02-08	0	19.8	8.0	33.3	61.4	9.9	6.8
2017-02-09	0	23.1	11.0	35.9	56.4	11.8	8.8
2017-02-10	0	22.5	12.4	33.8	61.0	13.1	10.8
2017-02-11	0	22.7	12.1	33.6	60.1	13.0	10.1
2017-02-12	0	21.4	10.0	34.0	64.0	12.5	7.6
2017-02-13	0	21.6	10.2	33.3	60.2	11.9	7.9
2017-02-14	0	21.8	10.3	34.3	56.5	10.4	8.7
2017-02-15	0	24.7	13.5	36.4	48.9	11.2	8.4
2017-02-16	0	24.3	11.6	34.9	49.2	10.7	6.6
2017-02-17	0	25.2	14.3	35.7	48.7	12.1	9.6
2017-02-18	0	23.7	10.4	37.0	56.2	12.0	9.1
2017-02-19	0.2	25.8	15.0	36.9	56.6	15.0	12.5
2017-02-20	0	26.5	15.2	36.4	56.3	15.5	13.2
2017-02-21	0	28.0	17.8	38.4	52.7	15.7	12.2
2017-02-22	0	26.3	16.8	39.9	42.8	9.4	2.3
2017-02-23	0	25.6	12.1	40.5	39.4	7.9	2.2
2017-02-24	0	24.8	11.1	37.4	39.0	6.4	-5.1
2017-02-25	0	23.1	9.9	35.9	46.9	7.4	0.7
2017-02-26	0	23.4	11.0	37.6	44.6	7.4	-4.0
2017-02-27	0	25.4	12.0	38.3	44.9	9.8	5.0
2017-02-28	0	26.4	15.0	39.2	49.9	12.9	7.5
2017-02-29	0	27.0	19.2	38.6	54.1	15.5	10.9
2017-03-01	0	25.7	18.8	35.3	56.4	15.5	11.5
2017-03-02	4.6	23.8	14.7	36.9	65.0	15.4	12.0
2017-03-03	0	25.0	16.9	35.1	63.2	16.0	12.0
2017-03-04	0	23.4	14.4	34.1	60.6	13.6	10.7
2017-03-05	0	26.1	14.2	38.3	51.6	12.9	8.9
2017-03-06	0	24.4	13.1	37.5	50.1	10.2	4.8
2017-03-07	0	24.6	11.1	38.7	44.3	7.7	3.1
2017-03-08	0	25.7	13.7	39.1	42.6	8.8	4.8
2017-03-09	0	26.1	14.0	39.1	41.9	8.6	3.3
2017-03-10	0	26.4	13.1	40.1	42.1	9.2	5.3
2017-03-11	0	27.4	13.9	41.3	38.4	8.3	4.4
2017-03-12	0	27.8	15.5	39.5	40.1	10.0	2.1
2017-03-13	0	25.3	13.8	36.0	40.2	8.7	3.6
2017-03-14	0	24.0	9.3	35.8	46.9	8.4	1.3
2017-03-15	0	25.2	11.8	39.0	51.7	11.0	-0.2
2017-03-16	0	25.8	12.9	37.5	52.1	12.1	4.9
2017-03-17	0	27.0	13.1	38.9	47.7	11.8	7.0

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2017-03-18	0.2	28.1	14.4	40.3	45.1	11.5	5.5
2017-03-19	0	28.9	14.2	41.4	39.2	9.8	4.6
2017-03-20	0	28.7	15.2	41.0	34.7	8.8	5.4
2017-03-21	0	27.6	13.0	39.8	34.4	7.0	3.1
2017-03-22	0	25.9	9.9	40.0	30.4	2.6	-10.3
2017-03-23	0	26.1	11.9	40.3	35.5	5.2	-3.1
2017-03-24	0	28.5	14.2	41.3	37.5	9.4	-0.5
2017-03-25	0	30.6	19.3	41.5	46.5	15.7	8.3
2017-03-26	0	30.8	19.9	41.9	50.6	16.0	5.9
2017-03-27	0	28.9	18.5	41.3	42.0	11.9	4.7
2017-03-28	0	29.4	14.9	40.4	32.5	7.9	2.9
2017-03-29	0	28.0	14.5	40.5	30.6	5.3	-3.7
2017-03-30	0	27.9	13.3	40.6	30.8	5.6	-2.7
2017-03-31	0	28.6	13.7	40.9	32.3	6.0	-2.0
2017-04-01	0	28.7	13.5	41.6	29.9	5.5	-2.8

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