Cover Crops Update

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Definition of Soil Health

"The capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health."

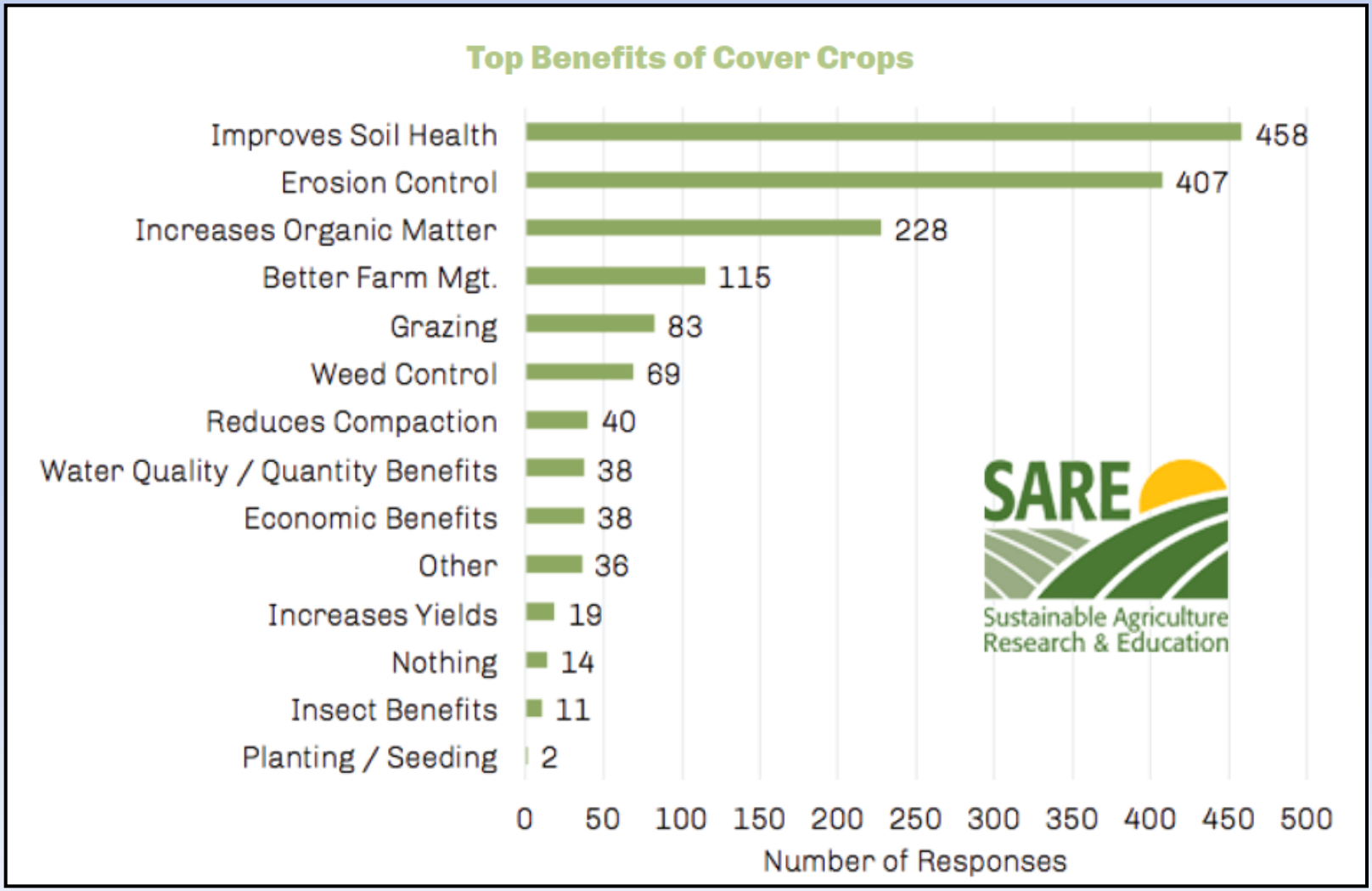
(Doran and Zeiss, 2000).

Cover Crop Definition

- A close-growing crop, that provides soil protection, seeding protection and soil improvement between periods of normal crop production…"(SSSA, 2008).
- A cover crop is grown during the dormant period following a cash crop and terminated before the planting of the next crop. (Hartwig and Ammon, 2002).

Cover Crop History

- The past:
  - In 1938, the USDA Yearbook of Agriculture recommended cover crops to maintain soil organic matter (Pieters and McKee, 1938).
- Present-day Kansas estimates:
  - Cover Crops were planted on 2,498 farms, 322,454 acres (US Census of Ag 2012)
  - Out of 21 million acres of cropland harvested/year
  - 1.5% of acres cover cropped each year



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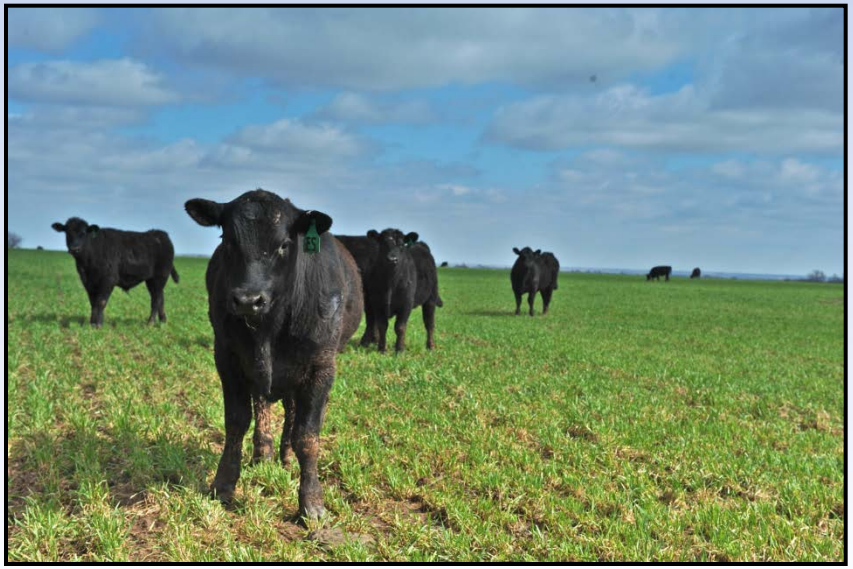
Farmer Survey: SARE 2015-16

KSU Research with Cover Crops

- 10-year study of Cover Crops in a No-till Wheat-Sorghum-Soybean Rotation
- Multi-Species Cover Crop Mixtures
  Forage Quality



10-year No-till (Crop rotation) Conclusions

- On average cover crops had little affect on yields of soybean and wheat in a rotation of Wheat-CC/Sorghum/Soybean
- 2012 drought year (sorghum yields <70 bu/a)
  - ✓ Yields of all grain crops were equal or better if summer double or cover crops were in the rotation
  - ✓ Winter cover crops reduced yield of sorghum
- Sorghum yields could be maximized with less fertilizer N with a legume cover crop or double crop planted after wheat
  (Average of 20 to 30 lb N/acre contributed by DCSB and FSB)
  - ✓ Yield differences with and without cover crops could be overcome with additional N
  - ✓ Implies that water is not an issue on average
  - ✓ Water extraction from deep in profile in 2015 and 2016 (good sorghum yields, up to 150 bu/a) might be effecting sorghum yield

10-year No-till (Crop rotation) Conclusions

- Double crop soybeans and cover crops reduced soil water content compared to chemical fallow, but the 5-ft. soil profile was recharged before sorghum planting in 2015.
- Double crop soybeans and cover crops reduced soil water content compared to chemical fallow, but only tillage radish and crimson clover maintained a significant reduction in the 9-ft. soil profile before sorghum planting in 2016.
- Both years had substantial April and May precipitation.

10-year No-till (Crop rotation) Conclusions

- **Cover crops could be incorporated into a NT rotation with minimal negative and some positive effect on yields of the cash crops.**
  - ✓ **In this environment (36” annual precipitation), cover crops typically didn’t deplete soil water enough to reduce cash crop yield.**
  - ✓ **Residue composition (C:N) influenced sorghum yield.**
- **Cover crops were slowly building soil carbon near the surface (3”).**
- **Nutrient stratification might have been influenced by cover crops, implying adjustments to nutrient rates and placement.**

Multi-Species Cover Crop Mixtures and Forage Quality

- Many cover crop species produce excellent quality forage
- Grazing a cover crop may offset management costs
  - Cover crop establishment and termination
- High quality supplemental forage allows a rest period for pastures
- Diversify crop rotation

Treatment Combinations

Brassica

- Turnip
- Radish

turnip (2.3)
or radish (3)

Grass

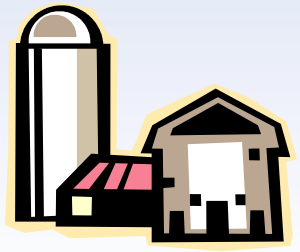
- Wheat
- Rye
- Oat
- Barley

wheat, rye, barley (30) or oat (37.5)

Legume

- Winter Pea
- Berseem Clover

winter pea (19) or
berseem clover (3.7)



******Numbers reflect seeding rates in lbs./acre**

Planting and Clipping Dates

	2014	2015
Planting	August 12	August 21
45-day Clip	September 26	October 6
74-day Clip	October 25	November 3
91-day Clip	November 11	November 23

Seeding rates and cost per acre

• Wheat (30)	$8.88
• Rye (30)	$10.52
• Barley (30)	$10.96
• Oat (37.5)	$8.68
• Radish (3)	$7.04
• Turnip (2.3)	$4.12
Winter pea (19)	$11.83
Berseem clover (3.7)	$8.31

Partial budget analysis comparison of individual species: biomass vs. seed cost

- Turnip = Radish
- Oat > Barley > Wheat or Rye
- Most pea we ever saw was 20% of the biomass

Conclusions (Grazing/Quality)

- Careful selection of species, and seeding rates, is important
  - Berseem clover was not competitive in these mixes
  - Turnips were more frost tolerant than radishes
- Species expression changed vastly each year likely due to weather
- Biomass was different in each year
  - Froze before the 91-day clipping in 2014
- During fall vegetative growth, legume didn't increase total biomass or forage quality

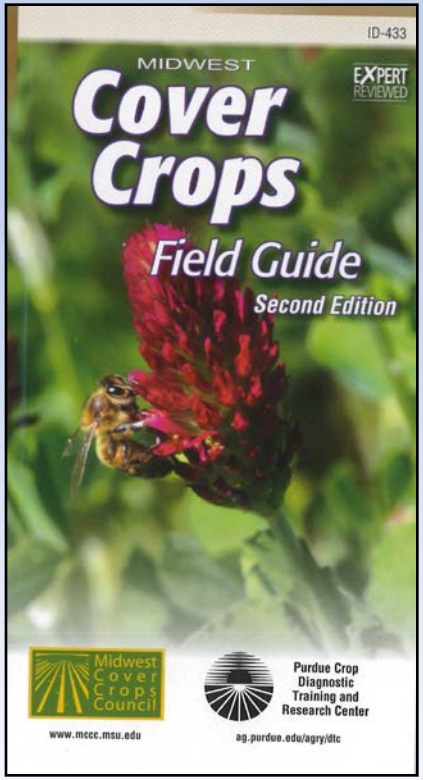
Conclusions Economic Comparison

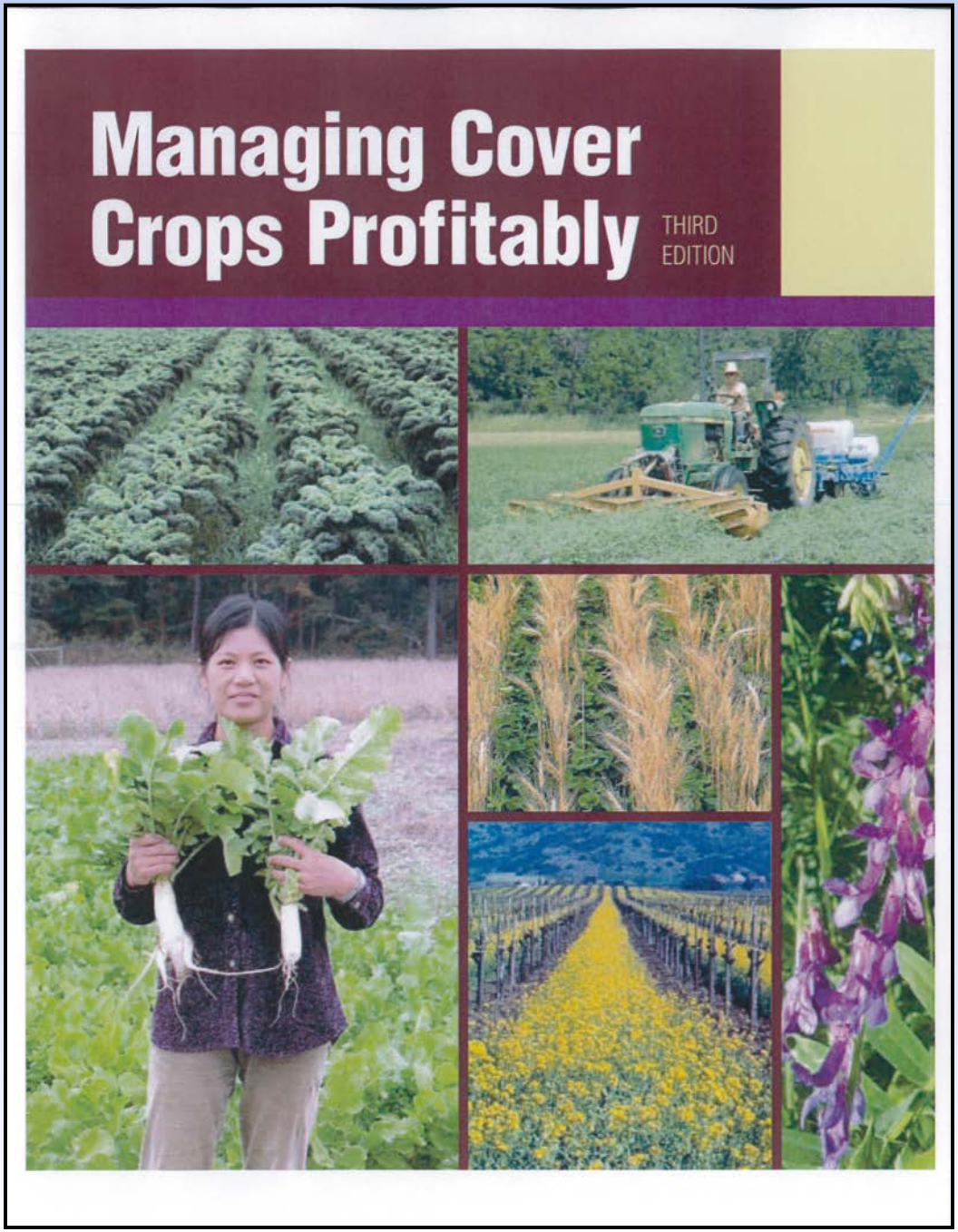
- The most economical mixtures contained turnip and oat species. Both of these species produced the greatest biomass in relation to dollars spent on seed.
- Barley and oat produced more biomass in both years over wheat and rye, likely due to early planting (planted in mid August instead of mid to late September).
- Adding a legume did not increase protein or overall biomass, but it did increase the cost of the mix.

Midwest Cover Crop Council

- Created and supported by several (17) land-grant universities including KSU.
- ONLINE Interactive Cover Crop tool in helping with the selection progress in the Midwest U.S.
- Allows many different options for the selection process including identifying your goals.
- http://mccc.msu.edu/covercroptool/covercroptool.php

Midwest Cover Crop Council





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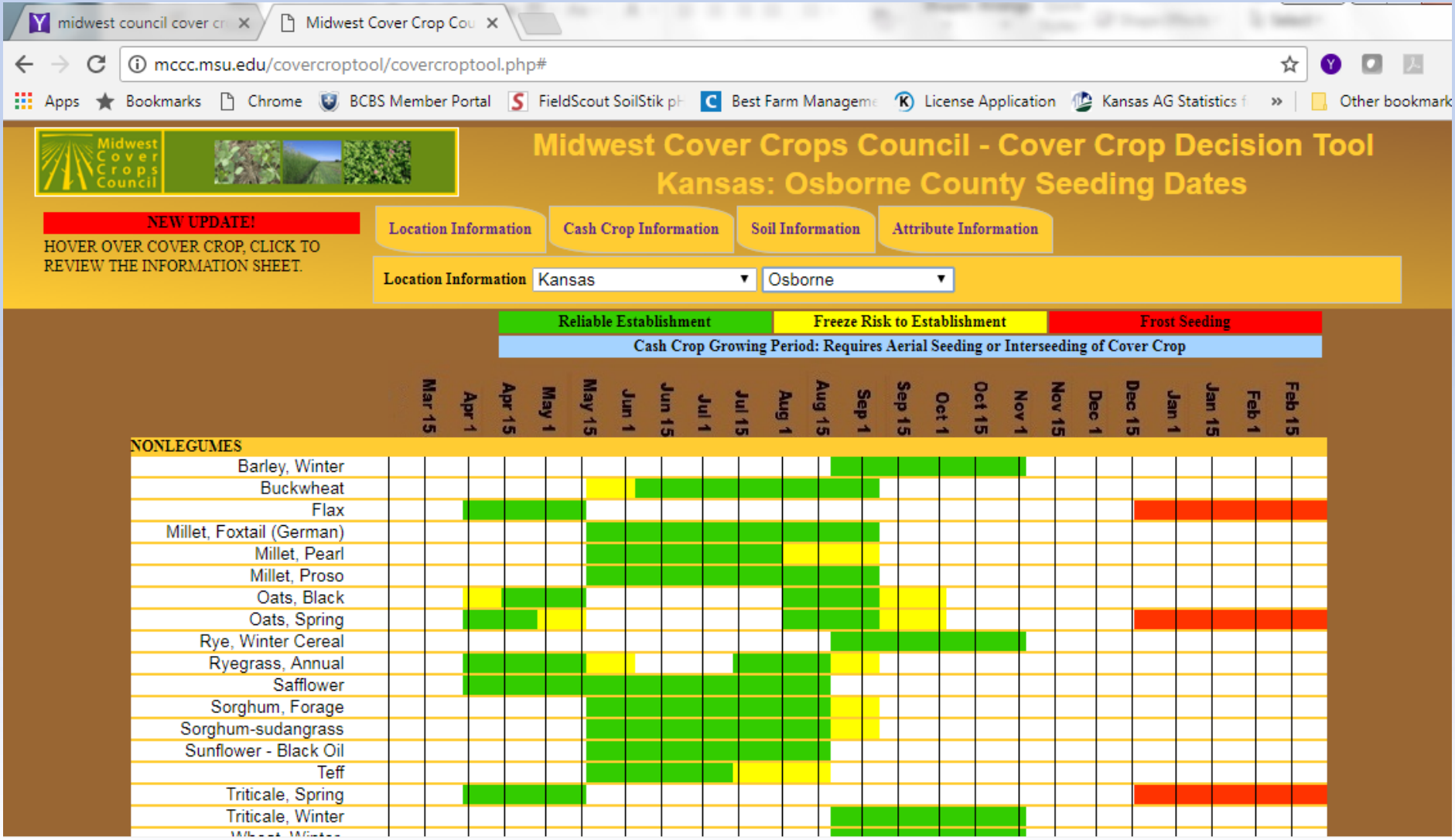

Questions?

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