NEW SOIL RECONSTRUCTION METHOD FOR RECLAIMING SUBSIDED LAND WITH YELLOW RIVER SEDIMENTS

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Outline

 ✓ Background
 ✓ Problems of filling reclamation
 ✓ A new reconstruction method for reclaiming subsided land with Yellow River Sediments
 ✓ Conclusions
 ✓ Information about the 2nd International Symposium on Land Reclamation and Ecological Restoration in October
Coal is the most important resource in China, accounting for about 70% of energy consumption. China’s coal output was 3.68 billion tons in 2015. About 90% was from underground mining.
• Subsidence: over 1 million hectare of subsided land; 70 thousands ha of land is subsided every year (estimated in 2011)
Coal Mining and Mining Subsidence in China

Eastern China

Relatively Flat Terrain

High Quality Farmland

High Underground Water Table

Created many lakes and wetlands, 85% of which was cultivated land before mining
The Overlap Region (OR) covers about 10.8% of the farmland in China. Reclamation of farmland is extremely important in China, with 133 million ha of farmland impacted by coal mining subsidence. Overlap Region (OR) is a significant area where farmland and coal reserves intersect, requiring careful management to balance extraction and sustainability.
Problem:

- Large overlapping areas of crop and coal production base, a lot of prime farmland damaged or to be damaged
- High density population
- Shortage of land is serious

It’s very urgent to restore farmland as much as possible!!
In General,

**Farmland Reclamation**

has become an urgent task in China
2. Problems of filling reclamation

Subsidence land reclamation in China: non filling and filling reclamation

Traditional non-filing reclamation could restore less farmland due to high ground water lever and a lot of land sink into water.

Digging deep to fill shallow with hydraulic dredge pump.
2. Problems of filling reclamation

Filling reclamation is an effective measure to restore much more land (more than 90% farmland)
Disadvantage of filling reclamation with coal wastes and fly ash

- Filling reclamation needs lots of reclaimed materials, but coal wastes and fly ash has been almost recycled in coal mine area now, there are no enough reclaimed materials
- The heavy metal contained in reclaimed materials may cause pollution on the quality of crop products, soil, surface water and underground water

Try to find good and enough filling materials.
The sediment concentration in Yellow River water is high, and Yellow River has become a river on the ground, which seriously threaten the life and property safety of the masses along the river.

Therefore, Yellow River sediments could be the potential filling materials for reclaiming subsidence land.

Advantage of filling reclamation with Yellow River sediments:

- enough sediment
- Less risk of pollution
- Increase farmland significantly
- Reduce the elevation of Yellow River bed, improve the river’s flood control, turn the wastes to useful materials.
Process of **one-time** filling reclamation of mining subsidence land with Yellow River sediment.
The technical process of **one-time filling reclamation of mining subsidence land with Yellow River sediment.**
before reclamation

after reclamation

control farmland

Wheat field (normal control farmland)

Grow well

50% yield

Wheat field (reclaimed farmland)

Grow bad (not enough thickness of covering soil)
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<th>Grain number per plant</th>
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<th>Root length per plant (cm)</th>
<th>Dry weight per plant (g)</th>
<th>Thousand kernel weight (g)</th>
<th>Estimated yield (kg·hm⁻²)</th>
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**WHY?**
Soil properties of reclaimed land filled with Yellow river sediments

Soil profile pattern is the KEY
Problems of traditional filling reclamation method

Traditional filling reclamation method was: 1) stripping the soils to be reclaimed land; 2) filling the subsided land materials at once; 3) backfilling the soils. This kind of **simple soil profile is an unfavorable profile type in pedology**, resulting in poor productivity.
3. A new reconstruction method for reclaiming subsided land with Yellow River Sediments

Multilayered soil profiles were favorable for maize growth, water-holding and storage capacity and nutrient preserving capability.
Laboratory simulation test

Design of different multilayered soil-sediment profiles

Joint training a Ph. D student with Prof. Kevin McSweeney (UIUC)
Results and Discussion: Compared to CK2 (traditional soil reconstructed profile, i.e. filling materials of Yellow river sediment cover with 70cm soil), T8 and T11 had an increase of 22.60%, 15.50% for plant growth, respectively.

Compared to CK1, T8, T10, T11 had an increase of dry biomass of root system at 36.64%, 29.78%, 29.96%.

The results illustrate that multilayer soil profiles were favorable for maize seed germination and root growth.

- 70cm soil cover
- Multilayer soil profile
Field test design of different multilayered soil-sediment profiles
There was no difference between filling reclamation and normal control farmland

Before filling reclamation  After filling reclamation  normal control farmland
Results and Discussion: Compared to contrast (traditional soil reconstructed profile, i.e. filling materials of Yellow river sediment cover with 70cm soil), T7, T8 and T10 had an increase of 3.68%, 1.59%, 2.42% for maize yield, respectively.

Laboratory and field test have got the same result.
A new filling technology is created. This technology focuses on: soil stripping, multiple filling, multiple backfill, leveling and others.
Process of *multiple filling* reclamation of mining subsidence land with Yellow River sediment.

- Determining the soil thickness in the area to be filled, dividing the strip
- Determining the soil profile, the number and thickness of sediment filling
- Determining the sequence of filling strip and number of synchronous alternating filling
- Determining area of soil stripping and stacking

Soil delamination stripping of synchronous alternate filling strip

Topsoil backfill

Synchronous alternating strips successively filling sediment - drainage-covering subsoil

Created by Zhenqi HU, Chinese Patent: ZL201510752726.5
Technology of alternating multiple filling reclamation

synchronous alternating strips successively filling sediment -drainage-covering subsoil

Created by Zhenqi HU, Chinese Patent: ZL201510752726.5
4. Conclusions

A new reconstruction method for reclaiming subsided land with Yellow River Sediments is created.

✓ For single filling layer, 70cm soil cover is needed.
✓ Multilayered soil profiles is benefit for retaining water and fertilizer, resulting in good growth of crops, which is the effective measure to restore high quality farmland for filing reclamation.
✓ The technical process for multilayered soil profile is alternating strips and filling, multi-filling.
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The 2nd International Symposium on Land Reclamation and Ecological Restoration
October 20-23, 2017, Holiday Inn Xi'an Big Wild Goose Pagoda
Theme: Land Reclamation in Ecological Fragile Areas

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China University of Mining and Technology (Beijing)

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Xi’an University of Science and Technology
Chinese Ecological Restoration Network (www.ER-CHINA.com)

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The symposium on land reclamation and ecological rehabilitation is a series of international conference, held every three years. The first symposium was held successfully on 16th - 19th October, 2014 in Beijing, China. Nearly 60 foreign scholars from 15 countries and more than 300 domestic scholars to participate the symposium. The deep discussion and communication of mine restoration and land reclamation in China including legislation and practice, technology and theory and so on, promote the development of the mining area ecological environment and land reclamation.
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Major topics covered by the Conference, but not limited, are as follows:
Mining impact on environment
Monitoring, prediction and assessment of mining impact on land environment
Mining methods and measurements to minimize the land and environment impact
Mining and reclamation policies, regulations and standard
AMD treatment
Soil and landscape reconstruction
Revegetation and biodiversity protection
Subsidence land reclamation and ecological restoration
Surface mined land reclamation and ecological restoration
Solid wastes management, waste dump and tailings pond restoration
Case study
Abandoned mine land reclamation and ecological restoration
Contaminated land remediation
Reclaimed land monitoring and evaluation
Land reclamation supervision
Products and industrialization
Education, technology transfer and international cooperation of mine land reclamation
“The Belt and Road Initiative” and mine land Restoration

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Emperor Qin's Terra Cotta Warriors

The famous historic and cultural city

Interesting places and good food
THANK YOU FOR YOUR ATTENTION!

QUESTIONS OR COMMENTS

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